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ROENTGENOLOGIC STUDY OF THE DUODENUM AFTER INTUBATION AND OBTURATION¹

By PAUL H. SHIFFER, M.D., *Stroudsburg, Pa.*

From the Gastro-intestinal Section of the Medical Clinic and the Radiological Clinic of the Hospital of the University of Pennsylvania

INTRODUCTION

ROENTGENOLOGIC investigation of the duodenum as now practised usually leads to the accurate diagnosis of such lesions of that organ as ulcer, duodenitis, diverticulum, adhesions, obstruction, or tumor, but the observations of some of these lesions are not quite so uniformly trustworthy as are those based on a similar study of the stomach. Not infrequently one has to be content with the demonstration of duodenal cap irregularity without commitment as to its cause: ulcer, adhesions, or spasm. Such uncertainty rarely exists regarding gastric defects, chiefly because the stomach can be well filled with an opaque medium which allows its outlines under tension to be clearly visualized on the fluoroscopic screen and on films. Such favorable conditions in the duodenum are not uniformly obtainable because the opaque substance administered orally and first filling the stomach, reaches the duodenum slowly and in small masses that are very readily passed on to the jejunum. For this rea-

son the duodenum is often not well filled even for a short time. Furthermore, the examiner is often unable to obtain a complete image of the duodenum, even when well filled, because the shadow of the barium-containing pyloric end of the stomach obscures it.

Frequent attempts have been made to develop a technic that would overcome these obvious difficulties in the roentgenologic diagnosis of duodenal lesions, but none has obtained practical recognition or acceptance. The recent development of a double-lumened intestinal tube in this section of the Medical Clinic by Miller and Abbott (1) suggested to me that such a tube might be employed in a practical way to aid in the diagnosis of certain obscure duodenal lesions. It will be noted below that somewhat similar methods of study have been referred to by various writers, but I was not aware of these described technics when this work was undertaken; also, apparently no one of them has been subjected to extensive clinical test or is sufficiently simple in application to justify its routine use in obscure cases.

Literature.—The introduction of an opaque substance by tube directly into the duodenum for its roentgenologic visualization has been practised many times: by Einhorn (2), David (3), Wheelon (4),

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Palesfki (5), Buckstein (6), Saraconi (7), and Castex (8). Such a technic has an advantage over the usual method in that it renders the entire organ visible, but it often fails to clarify the diagnosis because the mixture is not retained in the duodenum long enough to allow one to make a satisfactory examination. This is particularly true if the lesion causes irritability or spasm.

An advance was made by Cole (9), who, using a single Einhorn pyloric dilator passed to the distal portion of the duodenum, caused a blockage in the organ by distention of the balloon at the end of the tube and then gave an opaque meal by mouth. He suggested that a double tube might be used, a blockage produced by a bag connected with one lumen, and then a bismuth or barium mixture introduced proximal to the balloon by the other lumen. In 1913, Einhorn (10) published an article showing that he had applied this method of study and presented a roentgenogram that illustrated an air-filled balloon in the duodenum and a bismuth-filled cap proximal to it. Van Nuys (11), in 1921, gave a preliminary report on the use of a similar technic but with a different type of tube. In 1927, Pribram and Kleiber (12) used duodenal blockage with retrograde filling by an opaque substance, and went one step farther by producing a "pneumo-duodenum" in order to secure a double contrast image. None of these authors has referred to an extensive experience with his method. Thus, although the use of a double-lumened tube to produce duodenal obstruction and to fill the duodenal cap has been used before, little evidence has been recorded of its practicability or its advantages. This paper proposes to call attention again to its value, to describe in detail a new and practicable technic, and to report observations on a number of normal and pathologic cases.

Technic.—The tube which I have employed is 106 cm. in length with an outside diameter of 6 millimeters. It is divided longitudinally into two lumina by a rubber partition, one leading to a balloon (an

ordinary finger cot) at its distal end, and the other lumen to an opening just proximal to the attachment of the balloon. A duodenal bucket at the distal end of the tube over which the balloon is attached is employed for the purpose of making easier the localization of the distal end of the tube under the fluoroscope. A Luer syringe is used to inject air, usually about 40 c.c., into the balloon. The size of the balloon and the amount of air necessary to distend it are tested prior to each intubation. When the balloon is in place it is distended with air. A barium mixture is then allowed to run from a small vessel by gravity into the duodenum proximal to the balloon, the speed of flow being regulated by the height of the reservoir.

The patient is intubated after a twelve- to fifteen-hour fast. The time required for the balloon to reach the duodenum in my series of cases varied from one-half to one and a half hours. If fluoroscopic control and manual manipulation, as described by Morgenstern (13) or Rousselot and Bauman (14), are used, this time can be shortened. It is well to have an inch or two of slack tube in the stomach so that it does not hug too closely the lesser curvature of the stomach, a condition which sometimes produces nausea. The ideal place in the duodenum for the balloon to be located finally is in the third or fourth portion. If proximal to this point, it is apt to be regurgitated into the stomach when air is injected. When in the proper position the balloon is slowly inflated. A word of caution must be spoken at this point. Too much air must not be used at first or the purpose of the examination will be defeated. If enough distention is used to cause an undue stretching of the duodenal wall, violent reverse peristalsis is initiated, with regurgitation of the balloon. It is better not to demand a complete obstruction at first because the examiner does not always know when he is working in the presence of an acute lesion that may be made worse by too much distention. Caution must also be used when the barium is allowed to run in so that a

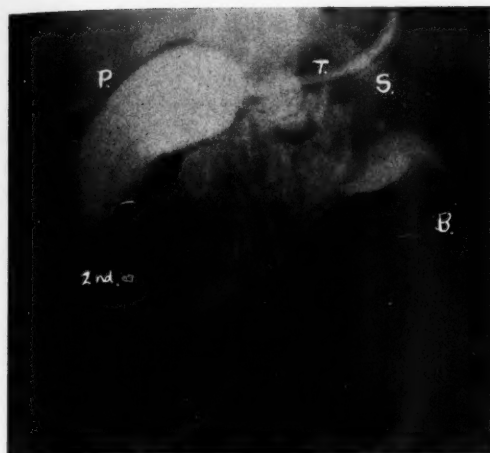


Fig. 1. Intubation and retrograde filling in a normal case. P, Duodenal cap. T, Tube. S, Stomach. B, Balloon distended at area of Treitz.

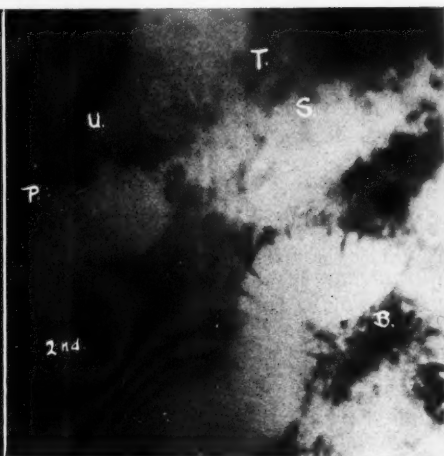


Fig. 2. A case of duodenal ulcer. S, Stomach with regurgitated barium. T, Tube in stomach. P, Duodenal cap. U, Ulcer niche. 2nd, Second portion of duodenum. B, Balloon in fourth portion.

too sudden increase of pressure in the duodenum shall not be caused. I feel that an amount of air just sufficient to distend the balloon to a diameter of 2.5 cm. as determined before intubation, should be injected at first, then the barium mixture allowed to run in slowly: if a small amount of the barium escapes beyond the balloon more air can be introduced slowly until one sees the opaque substance fill the proximal duodenum. Fluoroscopic observations are made continuously while the cap and the rest of the duodenum above the obstruction are being filled, films being exposed at any desired times. The tube is withdrawn after deflation of the balloon at the end of the examination.

Material.—Out-patients of the Gastro-intestinal Section and ward patients of the Medical Clinic of this hospital were available for this work. All of those subjected to the special investigation had previously undergone a gastro-intestinal roentgen examination by the regular method of the Radiologic Department of the hospital, this making it possible to compare the results of the two methods of study.

Forty-three intubations were attempted on 40 patients. The first 18 patients were

selected irrespective of their disease or previous roentgenologic results; the others were chosen because of the inconclusiveness of their original roentgenologic examination and the help that it was hoped might be secured by such a special study. Ten of the cases must be eliminated from consideration in the results; six (15 per cent of the total number) because of failure to get the balloon into the third portion of the duodenum, and four because of improper technic after intubation. Of the remaining 30 cases, 12 proved to be negative for any duodenal disease, while 18 showed pathologic lesions; seven, duodenal ulcer (one with adhesions); six, duodenal adhesions only; two, dilated ampulla of Vater; one, open communication between duodenum and common bile duct; one, an enlarged head of the pancreas, and one, mesenteric occlusion.

Results in Normal Cases.—The 12 patients in this group were considered to have no duodenal pathologic lesion on the basis of clinical study and routine roentgen examination. In them, retrograde filling of the duodenum with an opaque substance caused that organ to assume under the fluoroscope an appearance quite different

from that observed following the usual oral administration. The shape of the first portion corresponded more closely to that of a bulb than it did to that of a cap. It had the shape of a pear, with its larger end or base toward the pylorus of the stomach, instead of that of a miter-like cap setting on top of the gastric antrum. The shadow of the bulb was of a constant uniform density and seemed almost to be an extension of the antrum except for the sharp incisure of the pyloric muscle. The sides of this pear-shaped bulb were symmetrical and the clear-cut contour of the organ showed no irregularities, projections, or indentures. The size of the bulb varied with the amount of distention brought about in the individual case, and the measurements were not highly significant; it was possible, however, to estimate the point at which there was complete filling without appreciable stretching of the walls, and in this way a fair idea of the size was obtainable. Measurements were made on films taken in a uniform way during the examination. The width was determined at the widest part or base, and the length, from the pyloric ring to the beginning of the second portion of the duodenum (recognized by the point of maximal narrowing). The average width was 4.2 cm., and the average length was 5 centimeters. The second part of the duodenum extended posteriorly and downward from the end of the bulb to the inferior genu. It appeared as a cylinder of more or less uniform diameter throughout, the average width being 3.4 centimeters. The contour of this portion was unlike that of the bulb, showing multiple indentures on either wall of fairly uniform shape that were caused by the modified valvulae conniventes. There were no out-pouchings or extensions from the line of the walls, and the shadow was of uniform density. When this part was emptied of barium the arrangement of the mucosal pattern was seen as a lace-like network of thin pale strands.

No definite degree of irritability was observed in any part of the duodenum in

spite of the presence of the tube. At the first introduction of the barium mixture a small immobile deposit was noted, which then gradually regurgitated toward the pylorus. The bulb was usually retentive to the minimal or maximal amount of barium reaching it. After deflation of the balloon the whole duodenum emptied quickly, with the exception of the small amount which remained between the folds of mucosa in the second part.

Results in Pathologic Cases.—Evidence of pathology in the duodenum was revealed by some change in the shape, size, contour, or density of the roentgenologic shadow. The most conclusive evidence of an ulcer was the demonstration of a niche, caused by the opaque substance filling the crater of the ulcer and so giving in profile a projection from the wall of the bulb. When the right and left aspects of the cap were thrown into maximal relief by manipulation of the patient, the niche appeared as a small teat-like projection with a depressed area on either side. This appearing on one side only made the bulb asymmetrical (Fig. 2). Due to forced filling the whole ulcer crater was visualized and its direct connection with the bulb shadow was usually demonstrable: this is often not possible by the routine examination. When the opaque substance enters the duodenal bulb slowly from the stomach and no obstruction exists, the examiner is often at a loss to know whether he should attribute such irregularity to an incompletely filled cap or to organic disease. Furthermore, when a spot of barium lies apart from the larger mass in the unfilled cap, and a connection with it cannot be demonstrated, the examiner often cannot determine whether or not it represents an ulcer. With the intubation technique these difficulties did not arise, because, as before stated, the bulb presented itself as a solid shadow of definite outline and shape, and the filled ulcer crater showed a direct connection with the duodenal lumen. Because of this, one should be able by repeated examinations to determine if an ulcer is healing by observing a change in

the size of the niche from time to time. An incisura of the duodenal wall opposite the ulcer niche, such as is commonly observed in gastric ulcer, was seen fluoroscopically in three cases. This was undoubtedly due to spasm, since under increased filling pressure it was seen to lessen in depth and at times to disappear. By routine methods such a spasm may remain constant and thus be confused with an extrinsic disease or an actual organic constriction of the wall. It was not always possible to visualize the ulcer crater in relief, especially when it was present on the posterior wall; in such instances, however, it was demonstrable with the bulb only partially filled, or after it had been emptied, as a small fleck of opaque substance on the mucosal surface of the wall. From this fleck were seen several small, short, radiating strands caused by distortion of the mucosa about the edge of the ulcer crater. This appearance was analogous to that seen when using the "small meal technic." Besides the localized spasm, as characterized by an incisura, there was noted in the ulcer cases a general contraction of the whole duodenal bulb, which caused it to be somewhat smaller than normal. In the ulcer cases, the average width was 3.7 cm. and the average length 5.1 centimeters. In addition, some evidence of irritability in the ulcer cases was observed, and this sometimes caused a large amount of regurgitation of the barium mixture into the stomach before the cap became completely filled.

The presence of peri-bulbar adhesions often produces an irregularity which by the usual method of examination may be taken for a deformity due to an ulcer. This was not the case with our procedure, because the well filled niche was definitely characteristic and the irregularities of contour caused by adhesions in no way resembled it. In the presence of adhesions the bulbar wall had no wavy or saw-tooth appearance. The irregular projections from the otherwise smooth contour were sharply pointed as though held out by in-

visible threads. These areas were usually multiple, and no spasm or irritability was demonstrated in the cap. The ability to differentiate between adhesions and ulcer of the bulb by this technic commends its use in all doubtful cases.

In the second part of the duodenum, adhesions revealed themselves by a displacement of the intestinal wall in localized areas. The shadow appeared as an angular projection from its contour, either single or multiple, with some shift of the whole image in that area in the same direction. The width of the organ was increased to 4.5 cm. in one case and to 4 cm. in another case, with adhesions of the pulling type. In another case in which the adhesions were of a constricting nature and affected the whole circumference of the intestine, the lumen was narrowed to 2 cm. in diameter. In cases showing evidences of adhesions about the second part, no enlargement of the parts of the duodenum proximal to them was observed.

The size and shape of the duodenal cap were changed in four cases, without any irregularity in outline or contour being found. One of them showed a small cap 3.5 cm. wide and 4.5 cm. long, associated with a general spastic condition of the stomach and colon as shown by a previous routine study. Three cases showed an enlarged bulb, one being due to an occlusion at the site of the mesenteric vessels, and the other two, to stasis of undetermined origin. In the first case with a large bulb the latter was globular in shape and almost as wide as it was long, the width being 5 cm. and the length 6.5 centimeters. The second part of the duodenum in this case was also enlarged to a diameter of 5.5 cm. just proximal to the constricted area, which was only 1.7 cm. wide. Exaggerated peristalsis and reverse peristalsis were also noted in the dilated part. This was typical of an obstruction as the whole proximal duodenum was enlarged above the constriction and the barium remained in the dilated part longer than usual after deflation of the balloon. In the two other cases of stasis

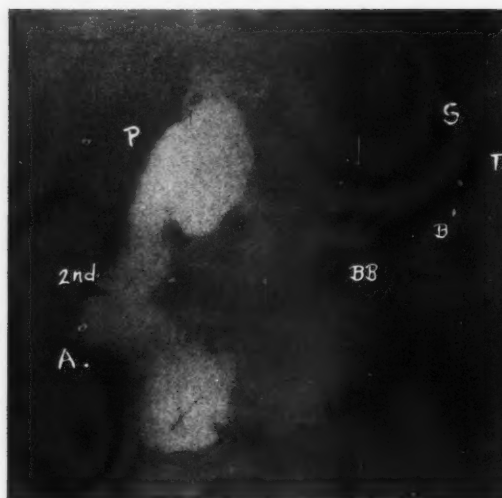


Fig. 3. A case of duodenal adhesions. S, Stomach. T, Tube in stomach. 2nd, Second portion of duodenum. P, Duodenal cap. B, Dilated balloon. BB, Bucket inside of balloon. A, Adhesions.

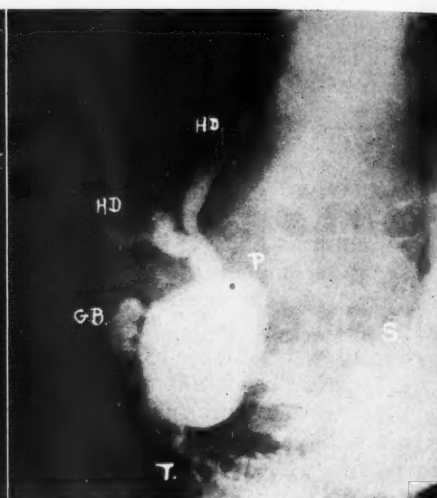


Fig. 4. A case of cholecystoduodenal fistula. S, Stomach with regurgitated barium. P, Duodenal cap. GB, Barium in gall bladder. T, Tube in second portion of duodenum. HD, Hepatic duct.

the bulb measured 4.5 cm. by 6.5 cm., and 5.5 cm. by 4.5 cm., respectively. They also were globular in shape and perfectly smooth in outline. The second part was 4.5 cm. wide in each instance. No evidence of undue retention of barium in the dilated parts and no excess peristalsis occurred.

Irritability of the duodenum was observed chiefly in the descending part. With the first introduction of the barium mixture in several cases a violent churning and reverse peristalsis were so marked that none of the opaque substance was retained in this portion of the duodenum throughout the examination and scarcely any stopped in the cap but was regurgitated back into the stomach. Increased forward peristalsis, revealed by a continuous effort of the intestine to propel the inflated balloon distally, also occurred. Examination by the usual barium meal technic rarely demonstrates such a degree of irritability because the meal passes out of the duodenal bulb in finger-like masses which are hurried toward the jejunum more or less in spurts, the rapidity of its

movement not always being recognizable. Under such circumstances reverse peristalsis does not occur unless there be distal obstruction, with marked stasis.

The common bile duct and right and left hepatic ducts were visualized in one case, due to a fistula between the common bile duct or gall bladder and the duodenum (Fig. 4). The bulb was globular in shape and slightly wider than long; the barium shadow extended into a small contracted gall bladder to its right and into the common bile duct and both hepatic ducts. This method made it possible to force the barium mixture into these channels. It was not possible in any other instance to force barium into the common bile duct—taken to be evidence that dilation of the duodenum alone is not sufficient to bring about an open communication between the duodenum and the common duct.

Two cases showed a smooth-walled sac budding from the mesial surface of the middle of the descending portion of the duodenum. These sacs were about one centimeter in diameter and retained barium after the remainder of the gut was

empty. On account of their location they were thought to be due to dilated ampullæ of Vater. In one case there was definite narrowing of the whole of the descending portion of the duodenum to a width of one centimeter. Operation showed that this was due to the extrinsic pressure of a dilated gall bladder on one side and of an enlarged pancreas on the other, evidenced by a greatly enlarged duodenal loop.

CONCLUSIONS

1. An improved technic is described for the roentgenologic study of the duodenum, utilizing a newly developed double-lumened tube by means of which the distal portion of the organ is obturated and the proximal portions are filled with an opaque substance in retrograde fashion.

2. The chief advantages of this procedure lie in the opportunity to fill completely the first and second portions of the duodenum, to distend them moderately, and to avoid the gastric shadow which with the usual opaque meal may obscure the duodenal image in cases with the hypertonic type of stomach.

3. As a result of experience with this special method of examination in 30 clinical cases, 12 of which were normal and 18 pathologic, it has been demonstrated that sometimes certain lesions, not clearly recognizable by the ordinary roentgenologic methods, may be identified.

4. In this series of cases the technic here described has served to confirm the diagnosis of a normal duodenum in twelve, of duodenal ulcer in seven, to differentiate adhesions from ulcer in four, to rule out both ulcer and adhesions in three, to demonstrate a cholecystoduodenal fistula in one, a dilated ampulla of Vater in three, duodenal occlusion or stasis in three, and

an enlarged head of the pancreas in one case.

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ROENTGEN THERAPY IN CHRONIC SINUSITIS¹

A FURTHER REPORT

By FRANK E. BUTLER, M.D., and IVAN M. WOOLLEY, M.D., *Portland, Oregon*

From the Department of Radiology, University of Oregon Medical School

IN 1930 our first roentgen treatment for chronic nasal accessory sinusitis was given, and the results obtained in this and 100 subsequent cases were presented before the Alumni Association of the University of Oregon Medical School in 1932 (1). At that time we were able to report 31 per cent symptom-free, 50 per cent definitely improved, and 19 per cent unchanged. These were all chronic cases which had been referred by their physicians as cases that were considered unresponsive to other therapy and therefore operative.

The rationale for such treatment was based upon the excellent results of x-ray therapy upon inflammatory and hypertrophic pathology elsewhere in the body, which have been known for years to respond satisfactorily.

The publication of our first report aroused considerable interest and also some criticism. Fears were expressed as to the possibility of damage to the skin, blood vessels, nerves, and even to the brain itself. These fears could be readily put at rest by referring to past experience, it having been repeatedly proved that roentgen therapy in the hands of a physician skilled in its use need cause no fear of damage. Safety rests with the skill of the operator in irradiation therapy just as it does in surgery or any of the other types of therapeutics.

It was also suggested that the sense of smell might be impaired or destroyed from the effects of irradiation. When one considers the fact that nerve tissue is the most resistant of all body structures to the effects of the x-ray (2 and 3), he need have

little to worry about on that score. None of our patients has mentioned any impairment in this regard, and one, who, by the way, has had by far the heaviest irradiation of any of our series, recovered the sense of smell which had been absent several years.

It was thought by some that an extreme fibrosis might result which would make it difficult, if not impossible, to properly extirpate the mucous membrane if such should become necessary in the event that the roentgen application failed. This objection has also been proved groundless, as will be pointed out later in this paper.

We were somewhat apprehensive as to the effect upon tooth buds in children and have exercised care in trying to shield them. Thus far there has been no evidence of any difficulty on this score, and in chronic sinusitis of children when radical surgery is contra-indicated, this form of treatment is particularly effective.

As to the action upon the cilia and cellular structures of the sinus membranes following irradiation, we could not definitely say. Logically, it could be expected that the lymphoid tissue and lymphoid cells would be broken down, with some later fibrosis, which would tend to sclerose the tissues and make it difficult for the infection to survive or for reinfection to occur. The shrinking of the membrane should then permit freer drainage of the cells.

Dr. Ralph Fenton, of the Department of Otolaryngology, and Dr. Olof Larsell, of the Department of Anatomy of the University of Oregon Medical School, had just completed some experimental work on acute sinusitis in cats, and they suggested that it might be possible to elaborate upon their technic in such a way as to

¹ Read before the Section on Radiology at the Eighty-fifth Annual Session of the American Medical Association, Cleveland, Ohio, June 13, 1934.

produce changes simulating chronic sinusitis in the human. Dr. Larsell and his assistant, Mr. L. M. Bain, were kind

time the cats were divided into three groups for study.

Group 1 consisted of three cats which

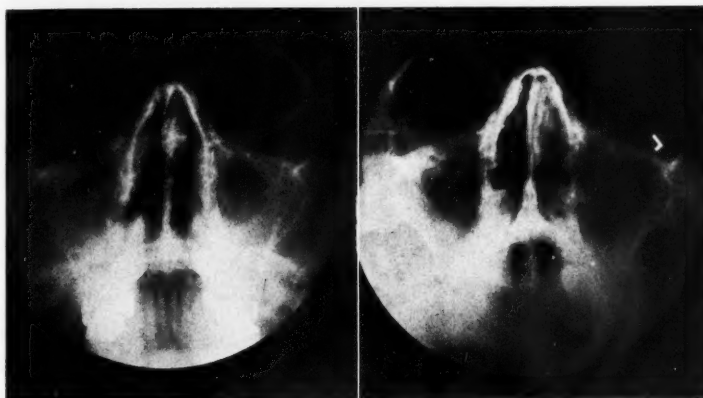


Fig. 1-A. Case 1. Radiograph of the antra at the time of the first treatment. Symptoms date back four years.

Fig. 1-B. Case 1. One year following first treatment. Symptomatically, much improved. Illustrative of Group 1.

enough to give us their help and in this way we were able to duplicate their technic and to elaborate upon it to suit the needs of this particular study. As to how closely we could approach tissue changes comparable to those in chronic sinusitis in humans, none of us knew. (Fenton and Larsell's work had been done entirely upon acute changes.) It was not known how long it might be possible to keep a cat infected, and this, with the other unknown factors, caused some doubt as to how complete our study might be, although we did feel that we could at least find out what, if any, harmful changes might result. Twelve cats were selected and the right frontal sinus in each was punctured and infected with a virulent hemolytic streptococcic culture taken from a mastoid (July, 1932). All of the cats showed definite evidence of infection within a few days and two of them died as the result of it. As before stated, it was not known how long it would be possible to maintain the infection, so we arbitrarily selected three weeks as the time that should elapse before treatment was instituted. Accordingly at the end of this

were irradiated over both frontal sinuses using the dose that we consider standard for the human (800 r).

Group 2 also consisted of three cats which received twice the standard dose (1,600 r) over both frontals, the increased dose being given to determine what harmful results might occur from excessive irradiation.

Group 3 consisted of the four remaining cats which had been infected but were not irradiated. These cats were used as controls.

One cat from each group was killed at the end of one week, a second at the end of three weeks, and a third at the end of three months, following irradiation. The sinuses were exposed for gross inspection and the anterior portions of the skulls were then placed in Zenker-formal solution. After the membranes had hardened, they were rolled in wheat shock manner, blocked, sectioned, and stained. It then appeared advisable to determine the earlier changes that might take place in the first few days following irradiation. Accordingly another series of cats was prepared as before and killed 24, 48, and 72 hours

following irradiation. The membranes were processed as above mentioned.²

Following the microscopic study of the

"In the animals given the double dose there was in one instance some indication of abnormal activity of the epithelium."

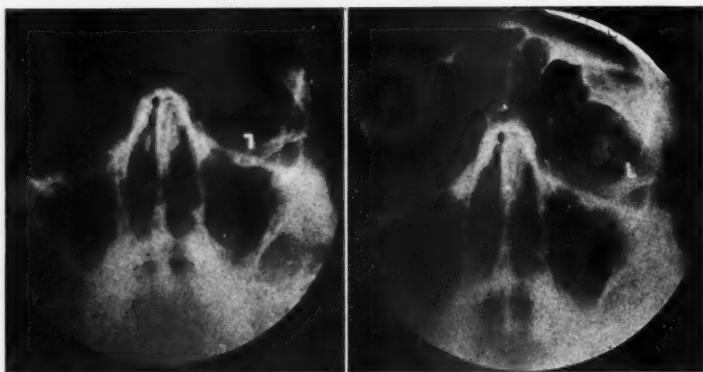


Fig. 2-A. Case 1. Appearance of the antra six weeks after the second treatment.

Fig. 2-B. Case 1. Radiograph made three months after the second treatment. Patient is symptom-free. Illustrative of Group 1.

slides prepared in this experiment, Dr. Larsell summarized the findings as follows:

"The effect of the x-ray treatment appears to be due primarily to an early destruction of the lymphocytes in the infected membranes. About 48 to 72 hours after treatment of membranes which had been infected for several weeks, there appears to be an increase in the number of macrophages. These are believed to come in response to substances released by the breaking down of the lymphocytes. These macrophages are seen to be laden with cellular debris and blood pigments. It is possible that they also engulf bacteria.

"The membrane becomes gradually reduced in thickness but retains numerous plasma cells, polymorphs, and some histocytes. After a week or more some fibrosis appears. Several weeks after irradiation, nodule-like masses of lymphocytes may be seen in some of the membranes, indicating a return of lymphocyte formation.

"There is no evidence of injury to the cilia, epithelium, or cellular elements other than the lymphocytes as the result of x-ray dosage. The fibrosis is considered a result of the inflammatory process, and the increased number of histocytes immediately following the infection.

² For the technic used throughout this work we refer the reader to Fenton and Larsell's article (4).

While this work has given us valuable information leading to a better understanding of how these tissues react to irradiation we felt that the results were not exactly comparable to what might be expected clinically, as we were forced to give heavy irradiation in the presence of acute and in some cases fulminating infection, which, of course, we would not do in treating a human. By this we do not wish to infer that roentgen therapy is contraindicated in acute sinusitis, but in such cases the dose must be kept considerably lower.

We realize that the experimental work here reported does not begin to tell the entire story and we have no doubt that with the knowledge gained in this series, further studies along this line should give more complete information. Having in a measure established the background of the rationale of roentgen therapy in this field, a report of the clinical results obtained by this method should prove to be of interest.

Our clinical experience is based upon a series of 700 cases which may be roughly divided into five groups, as follows:

Group 1. Chronic infection with hypertrophic membranes.

Group 2. Cases having polypi or cysts.

Group 3. Atrophic types of membrane.

Group 4. Chronic sinusitis with densely fibrotic membranes.

but all involved areas are treated upon the same day. The central ray is so directed as to produce a cross-firing of the

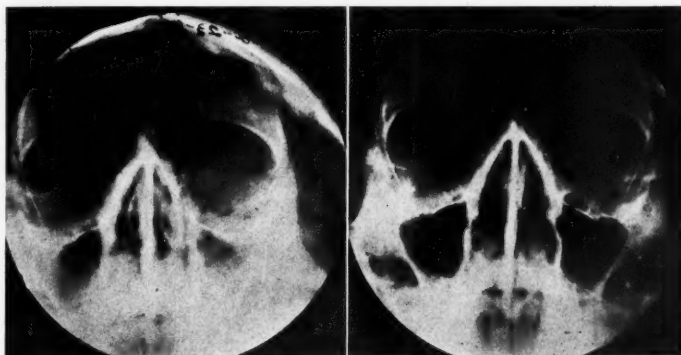


Fig. 3-A. Case 2. Radiograph showing the antra at time of treatment. Symptoms date back two years.

Fig. 3-B. Case 2. Six weeks following irradiation. Patient remains symptom-free. Illustrative of Group 1.

Group 5. Post-operative cases following unsuccessful radical surgery.

These are all cases of long-standing, some of them dating back as long as twenty years, and have been referred to us as patients who were definitely not allergic and who had failed to respond to the usual types of treatment. During the course of this series we have developed a rather definite technic, and our results, tabulated upon 450 cases in which it has been possible to obtain follow-up data, show 36 per cent that are entirely relieved up to the present time, 55 per cent definitely improved, and 9 per cent that have been only slightly improved or not helped at all.

In Group 1, consisting of chronic cases in which the radiograph shows a definitely thickened membrane with only a small air-containing cavity, we have had our best results. The technic used here consists of 120 K.V.P., 5 ma., 11 inch distance, 4 mm. of aluminum filter, for ten minutes through a port one and one-quarter inch in diameter. These factors as applied by our equipment give a dose of 800 roentgens as measured with the Victoreen instrument with back-scattering. This dose is applied over each group of cells separately,

posterior ethmoid and sphenoid cells. The eyes and the nose are carefully protected at all times.

The following case reports are illustrative of this group.

CASE REPORTS

Case 1. E. A. F., male, aged 45 years, was referred by his rhinologist for treatment. His symptoms dated back four years, during which time he had failed to respond to routine therapy. Radiographs taken on this date (March 31, 1931) showed bilateral thickening of the membranes in the antra, with hazing of the ethmoids also. The antra were irradiated and the patient failed to return until one year later. He reported decided improvement but still had some discharge. The membranes, although reduced, were still definitely thickened. The ethmoid fields were still hazy. A second treatment was given over the antra and this time the ethmoid areas were also included (April 2, 1932). A check-up six weeks later showed a definite improvement and no further treatment was given. Three months later (Aug. 17, 1932) he returned for treatment of a carbuncle and reported that he had had

no further evidence of sinus involvement. A film made on that date showed the sinuses to be clear.

Case 3. V. C., female, aged 8 years, was referred by a pediatrician, because of chronic sinus involvement with a severe

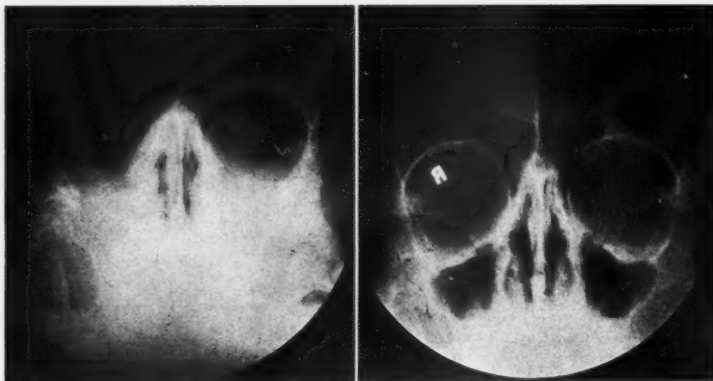


Fig. 4-A. Case 3. The patient was a child eight years of age. History of discharge and severe sinus bronchitis dates back six months.

Fig. 4-B. Case 3. Radiograph made seven months after irradiation when patient returned with whooping cough. Radiograph shows the antra clear except for a polyp or cyst in the floor of the right maxillary. Illustrative of Group Two.

Case 2. C. B., female, aged 40 years, was referred by her internist with a complaint of chronic nasal discharge, headache, and general malaise. Sinus involvement had been known for two years, but there had been no recent treatment. Irradiation was given on December 20, and the patient noted an increased discharge for six days, whereupon it gradually subsided and finally ceased entirely approximately ten days following treatment. A recheck on February 2 showed both antra to be clear and the patient reported complete recovery as far as her previous symptoms were concerned. More recent inquiry has elicited the information that she is still symptom-free.

In Group 2, in cases in which polypi or dental cysts are present, we have had no appreciable results except in a few cases that are still under observation; in these, the polypi have been excised and irradiation has been given in an attempt to abort a further development. Thus far the work appears to be very encouraging. The following case may be of some interest in this regard.

sinus bronchitis. At the time of the treatment (Sept. 7, 1933) both sinuses were opaque, and radiographically suggested an acute involvement although the history of the discharge and bronchitis dated back six months. She failed to report back to the pediatrician or to our office at the stipulated two month's interval. On April 19, she was returned by her mother, who complained that she was no better than at the time of her first visit. Questioning developed the fact that she had shown marked improvement within a week after treatment and that her discharge and bronchitis had subsided entirely within a month. She had developed another severe cough ten days before this last visit, which followed an acute rhinitis. Radiographic check-up showed both antra to be entirely clear except for a small cyst in the inferior angle of the right antrum. She was referred back to her physician, who diagnosed whooping cough, and there has been no developing evidence of sinus involvement.

In Group 3 the atrophic type of sinusitis has shown response, in some cases, to

repeated fractional doses in which we have given one-sixth of the standard 800 r dose every week for a period of six weeks.

now subside more or less spontaneously in a few days' time, although he still has some nasal discharge at times. It is possible

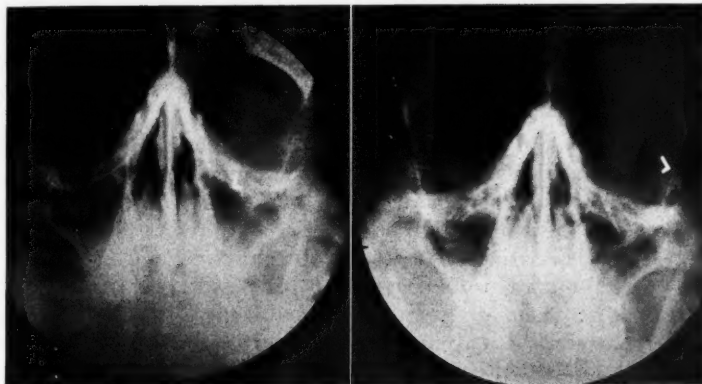


Fig. 5-A. Case 4. Radiograph at the time of treatment showing evidence of a pansinusitis. History of nasal discharge, sinus bronchitis, and recurrent head colds dates back many years.

Fig. 5-B. Case 4. Check-up film made ten months following irradiation. Patient reports marked clinical improvement. Illustrative of Group 4.

In Group 4, in which we encounter rather densely fibrotic membranes, we have found rather variable results. Some of these cases which appeared at the outset to present but little hope of result have returned free of symptoms, and radiographic check-up has shown an antrum of normal appearance. Others show varying degrees of improvement, and still others show no changes at all.

Case 4. This was a physician, aged 45 years, who stated that for a period of years he had never been free from nasal discharge of varying degrees of severity, and that every fresh cold precipitated an acute sinus flare-up, requiring loss of time of from several days to a week. Radiographs showed a chronic pansinusitis. He was irradiated on July 22, 1931, and obtained marked relief, but still had occasional discharge. He did not return until April, 1932, at which time the radiograph showed no appreciable change. The ethmoids were treated on this date. A recent conversation with him brought out the statement that he has had no acute flare-ups since the first treatment, that nose colds

that further treatment might produce additional benefit in this case.

In Group 5 we have also found some variation. For the most part these patients present sinuses that are practically occluded with dense fibrotic scar tissue and very little, if any, change can be detected following irradiation, although the patient frequently states that he is clinically improved. Except for the variations above noted, our technic is fairly standard. As before mentioned, the full dose is given at one visit, and the patient is asked to return in two months for a recheck. The usual reaction is that of stimulation at first, productive of increased discharge, which persists for from several days to a week, and then gradually subsides. A few cases have had an increased swelling of the membrane, producing occlusion of the ostium, necessitating puncture and washing. This, however, has been a rather rare complication. A few cases have reacted in an opposite manner in that the discharge has completely ceased within a few hours.

In those cases suffering from secondary

symptoms definitely ascribed to sinus infection, there has been a very gratifying response. Headaches, bronchitis, neuritis, and other minor complaints have cleared up, even in cases in which there was not a complete resolution of sinus pathology at the time the recheck was made. In the large majority of cases one treatment has been sufficient to gain satisfactory results, although many have required a second exposure in from two months to a year's time. One post-operative patient has received five treatments scattered over a period of three years and during the past year has remained quite comfortable. It has been our good fortune to escape sequelæ of a serious nature throughout this series, and, with the exception of two or three patients, none has lost any time from his work as the result of the treatment.

Our records show seven cases that have come to surgery following failure to secure relief from roentgen therapy. Fenton reports two cases of chronic maxillary sinusitis who received irradiation over one antrum, one month prior to bilateral extirpation in an effort to determine the comparative changes in the membranes. Of this total of seven known cases we have received pathologic reports on six, and a careful comparison of the slides shows but little change from the usual findings in similar, non-irradiated membranes. Here again was noted a return of lymphocytes in some of the membranes removed several months following irradiation, as was seen in some of our cat membranes. This brings up the question as to whether or not we might have succeeded had we given further irradiation at intervals over a longer period of time, thus providing further breaking down of lymphocytes and restimulation of histocytic invasion. Two post-operative membranes showed a considerable number of small cysts scattered throughout, and it appears that further irradiation of this type would give no additional benefit. In none of these membranes were there any evidences of damage to the normal cell structures, and the sur-

geons reported that there was no difficulty encountered in the removal of the tissues. This was also found to be true in the irradiated cat membranes.

Regarding our selections of dosage, we have found far better results in cases given single, full doses than in those in which fractional dosage was employed. We have further learned the necessity of treating all the infected areas at one time, thereby eliminating as much as possible the tendency toward reinfection from untreated foci. We have occasionally seen a slight erythema develop over the site of irradiation, but this has subsided without further difficulty.

In conclusion, we wish to place especial emphasis upon the fact that while we have stated rather positively that no harm has resulted from roentgen application in this series, we do not wish to leave the impression that the procedure is without danger. Roentgen therapy should not be attempted by any physician who is not well experienced in that field. Skin tolerance and proper filtration must at all times be kept in mind, and repeat treatment must not be given until a safe interval has elapsed. Serious and irreparable damage may result through careless or unskilled application of the roentgen ray. Of equal importance is the matter of diagnosis, and we should like to particularly stress the necessity of complete co-operation between the referring physician and the roentgenologist, in order to avoid treatment of cases in which roentgen therapy is definitely contra-indicated.

SUMMARY

1. Roentgen therapy has a definite place in the treatment of chronic paranasal sinusitis in properly selected cases.
2. The rationale for such therapy has been established.
3. There is no damage to normal structures, when properly applied.
4. Failure of roentgen therapy in no way interferes with subsequent surgery, should the latter become necessary.

5. Complete co-operation of the referring physician and roentgenologist, with proper selection of cases, should result in a higher percentage of cures.

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DISCUSSION

DR. A. U. DESJARDINS (Rochester, Minn.): This communication by Dr. Butler and Dr. Woolley is most interesting because it tends to show that inflammation of the paranasal sinuses, like inflammatory processes of different kinds elsewhere in the body, is distinctly amenable to radiotherapy. One point especially interests me, and this is the description by Dr. Larsell of the pathologic changes which he found in sections of infected sinus tissue treated with roentgen rays. The fact that the primary effect of the rays was an early destruction of lymphocytes infiltrating the infected membranes agrees with many other observations, experimental and clinical, which have been made in the past, and all of which tend to show that the first and main effect of irradiation on inflammatory processes is to destroy infiltrating lymphocytes. This is undoubtedly and necessarily accompanied by liberation of anti-bodies, ferments and other protective substances which these infiltrating lymphocytes may have contained, and is followed by an increase in phagocytosis. The description of these changes given by Dr. Larsell absolutely confirms this sequence of events.

Another point which interests me considerably is the doses of roentgen rays which Dr. Butler and Dr. Woolley have used in treating paranasal sinusitis in

human beings. I take it for granted that the dose of 800 roentgens, mentioned in the paper, means 800 roentgens measured on the skin (that is to say, with scattering). This would correspond to a dose of approximately 500 roentgens measured in air. If this assumption is correct and if we take into account the fact that paranasal sinusitis is usually a chronic inflammatory process, although it is characterized by occasional flare-ups, such a dose corresponds with the doses known to be effective in many other chronic inflammatory processes.

I am also impressed by the fact that one or, at most, two irradiations have been found sufficient to rid patients of this distressing condition. A minor point which might be mentioned is the increase in secretion which has been described as following irradiation and which is replaced later by diminished secretion. No doubt, the increase in secretion is due to the effect of the rays on the mucus-producing epithelial cells. It is well known that epithelial cells having the property of secreting mucus, undergo, after irradiation, mucoid degeneration, with increased secretion—it may continue for a number of days and be followed by reduction in the amount of secretion. In every respect, therefore, the experiences of Dr. Butler and Dr. Woolley, both on experimental animals and on human beings, agree with what is known to occur in many other forms of inflammation. Their report should lead to a revision of our ideas concerning the treatment of sinusitis and, as specialists make use of it, should prove a boon to many sufferers.

I think if the dose is somewhere between three-fourths and four-fifths of an erythema dose, I should be inclined to use more filter and more voltage. In dealing with inflammation of the sphenoid sinuses, which are fairly deep, too small a dose may not be so effective.

DR. RALPH A. FENTON (Portland, Oregon): Otolaryngologists are much interested in Dr. Woolley's fine piece of re-

search, which arose from our criticism of clinical results reported by Dr. Butler and Dr. Woolley two years ago before the Oregon Academy of Ophthalmology and Otolaryngology. We asked then what happened to these inflamed mucosal surfaces after irradiation; they told us of certain percentages, gratifyingly high, of clinical betterment, and of improved radiographic evidence. They were, however, unable to tell us what took place in the tissues, until microscopic examination of these cat membranes, infected after our technic.

Prof. Larsell and I have elsewhere reported on the examination of chronic cat membranes; and of certain human membranes, one month and six months after irradiation. It need not be emphasized to this Section that therapeutic use of the roentgen ray does not sterilize sinus membranes; they become swollen, often to such an extent (pointed out long ago in Vienna) as to cause annoying pressure symptoms from retained secretion. Then the killed lymphocytes are carried away by an inrush of phagocytic connective cells, with resultant local accumulation of immune substances, increased blood supply, and eventual fibrotic changes, without damage to epithelial structures.

This is all very well, if the membrane treated contains plenty of round cells to kill. What of the highly edematous membrane full of plasma cells, or the membrane already thick and fibrous? Either of these may contain numerous miliary to pea-sized abscesses or cysts, which will remain untouched by the irradiation. Either condition will look dark in the radiograph. So also will a syphilitic thickening of the mucosa; so will a beginning adenocarcinoma.

A word of warning must be sounded lest roentgenologists proceed to use this method indiscriminately, on the recommendation of general practitioners and pediatricists, or on their own. Every case, as Woolley states, must be checked before and after by a competent otolaryngologist; otherwise much trouble may ensue.

Let me say also that this treatment is no guarantee against recurrences. When foul dental roots are responsible for antral discharge; when allergic sensitiveness continues to block ethmoidal drainage and favor reinfection; when fibrotic membranes contain virulent streptococci in multiple abscesses surrounded by networks of new capillaries, we have repeatedly observed, clinically and under the microscope, that patients who have experienced temporary relief from roentgen-ray treatment of the sinuses will have recurrences that require both medical and surgical measures for permanent cure. Properly performed radical surgery is followed by regrowth of normal ciliated mucous membrane. One wonders whether, after therapeutic irradiation, the thickened and fibrotic membrane will in later years be as safe and as useful as the new, thin, and healthy membrane found after surgery is adequately done.

We have nothing but praise for the modesty of Dr. Woolley's conclusions, for his industry and his patience; but we would like further reports after the lapse of several years. Reports from Hamburg and Vienna were not so encouraging, when reported in Germany in 1927. Our laboratories welcome further research along this line, and we would suggest that animals kept infected for several months would afford a pretty good criterion of the eventual measure of repair in similarly chronic human cases. After all, the simple round-cell infiltrative type of sinusitis is that which yields most readily to ordinary measures. Here, Dr. Butler and Dr. Woolley have had their best results; however, they still consider this an experimental procedure.

There is real danger, however, that cytologic examination of sinus washings, lipiodol injection, and careful rhinologic study will be omitted by some radiologists who will attempt this method on any one who says he has "sinus trouble" or shows a slightly darkened sinus plate. This Section should look well to the danger that this valuable method, if indiscriminately

recommended, may get into the greedy hands of irresponsible and untrained quacks and irregular practitioners.

DR. G. A. ROBINSON (New York): I wish to congratulate the Doctor on giving us an added method of treatment in chronic sinusitis. There is a tendency (and I think rightly so) to do less radical surgery in nasal sinus disease.

We have used radium in a great many cases of polypoid ethmoiditis, with encouraging results. The method was started several years ago by Dr. Sluder and Dr. Lyons.

In polypoid ethmoiditis, Dr. Woolley reports his results as not so good as in the thickened membrane of the antrum and frontal sinus. One can deliver with the radium capsule as great a dose as one cares to give. It is difficult to apply a dose from a radium tube into a maxillary antrum, and we cannot use the time-consuming method of treating the sinuses externally with radium packs. We have tried it in a few cases and found clinical improvement.

DR. JOHN D. OSMOND (Cleveland, Ohio): I wish to congratulate Dr. Butler and Dr. Woolley on this presentation. It is a step forward.

I wish to give one caution in regard to the treatment of any case that is fairly acute and has retained pus. I began this treatment before 1922 and reported it at the 1922 Los Angeles meeting of the American Roentgen Ray Society. It was a small series, but I spoke a word of caution at that time—when the antrum or other infected sinus is not properly drained, one should not treat it. It must be washed out first. At that time I did not think that chronic sinusitis would do well, but I have since changed my mind. We have treated about 250 cases with comparable results.

DR. G. E. PFAHLER (Philadelphia): I, first of all, want to congratulate Dr. Woolley and his colleagues on this presen-

tation. It was one of the most important presentations we have had because the field is so very large. I also think that we are fortunate in having Dr. Fenton and Dr. Desjardins open this discussion.

I have not treated many cases of paranasal sinusitis. Most of the cases I have treated have been in physicians, one of whom was myself. Having suffered from paranasal sinusitis for approximately fifty years, and being in better condition now than I have been at any time during that period, I can speak rather feelingly.

I have not used the large doses. We have used high voltage x-rays, 0.5 mm. of copper filtration, and 25 per cent surface dose, giving the treatment at one time through the sinuses anteriorly, protecting the eyes, eyebrows, and lips. Then perhaps a week later, we treat laterally on one side and then on the other side. It does seem to me, theoretically, that that line of treatment ought to give us better results than all of this treatment in one dose.

DR. IVAN M. WOOLLEY (closing): I wish to thank the gentlemen who discussed this paper, especially Dr. Desjardins and Dr. Fenton, the latter of whom left his own Section to come here for that purpose.

We have not at any time held that this type of treatment was a cure-all for all types of sinus conditions. We believe it has a definite place in the field of sinus therapy, that with further experience it will definitely find its level, and that by this means we will be able to offer relief to many patients who at the present time are not being relieved.

As far as the caution about treating acute cases is concerned, it is a point well taken. We do not treat acute cases in their fulminating stage but wait until they are in the sub-acute stage.

The matter of diagnosis is extremely important and it is our hope, as the work develops, that co-operation between the otolaryngologist and the radiologist may be productive of a greater percentage of cures in these particular types of cases.

IRRADIATION OF RADIOSENSITIVE TUMORS¹

By MAX KAHN, M.D., *Baltimore, Md.*

IN a study of radiosensitive tumors it may be of interest to review one or two cases living for a number of years that had malignant tumors and that were treated with the roentgen ray. Patients are from time to time referred for roentgen therapy who either have an inoperable tumor, or a large tumor which is inaccessible to operation, or for palliative treatment. It is gratifying to find that the results in some of these hopeless cases are excellent, the patient remaining clinically well for years.

Therapeutic roentgen rays have been used for some years as a diagnostic agent in identifying the pathology of certain varieties of tumors. Desjardins (1), who has rather thoroughly reviewed this method of studying tumors, states that the specific sensitiveness of each kind of cell is the dominant single fact of radiology and should be recognized as a law. This sensitiveness appears to be related to the natural life cycle. Thus the lymphocytes, the metabolic cycle of which among human cells is the shortest, are also the most radiosensitive, and the nerve cells, the life cycle of which is the longest, are also the most resistant to irradiation. When, according to their radiosensitivity, certain cells or group of cells are exposed to a sufficient dose of roentgen rays or radium, the first perceptible effect is an alteration or series of changes in the nuclear portion, or genetic mechanism of the cells. Collectively, these changes are characterized by the arrest of mitotic division and by a partial or complete degeneration of the cells; individually, by disorganization and fragmentation of the nuclear chromatin, vacuolar degeneration of the protoplasm, rupture of the cell, and scattering of the fragments of chromatin from the nucleus among the cells which remain intact. He further states that

in many cases biopsy need not be done, but that correlation of the clinical, physical, roentgenologic, and radiotherapeutic evidence may often settle the diagnosis without a biopsy, or in the face of inconclusive or conflicting pathologic observations.

Ewing (2), in 1929, classified tumors in decreasing order of radiosensitivity as follows: (1) lymphoma; (2) embryonal tumors; (3) cellular anaplastic tumors; (4) basal-cell carcinoma; (5) adenoma and adenocarcinoma; (6) desmoplastic tumors, such as squamous carcinoma and fibrocarcinoma; (7) fibroblastic sarcoma, osteosarcoma, and neurosarcoma. Bloodgood (3), in 1930, published an excellent review of radiosensitive tumors, calling attention to the advantages of both surgery and radiation in the treatment of certain types of them.

In a review I made of some soft structure tumors (4), fibromas or fibrosarcomas were found to be radiosensitive or slow growing, and to fall into the group of moderate curability. One case of fibromyxoma of the antrum and nares, and another case of fibromyxosarcoma involving the antrum and ethmoidal region treated with the deep roentgen ray, are up to the present time clinically well five and five and a half years, respectively. In 1933, I published a review of bone tumors which were more or less radiosensitive (5). Included in the radiosensitive group is the giant-cell tumor, particularly the variant type. Cases of cure with the roentgen ray of this type of tumor have been reported. Chondroma is partly radiosensitive; following roentgen therapy, it may recalcify, become arrested and remain quiescent for many years. Of the malignant tumors, Ewing's sarcoma and chondroblastic sarcoma are radiosensitive; secondary chondromyxosarcoma and metastatic carcinoma are partly radiosensitive. In multiple myeloma, roentgen therapy is of

¹ To be presented before the Radiological Society of North America, December, 1934.

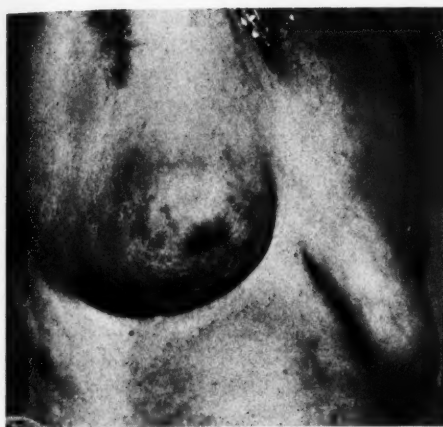


Fig. 1. Case 1. Primary cancer of the breast with retraction of the nipple, palpable tumor in the breast, and enlarged lymph node in the axilla. The skin was red. Case of carcinoma en cuirasse.



Fig. 2. Case 1. Film taken three months after the patient had received roentgen therapy. The nipple was reformed; the tumor and lymph node were not palpable. Redness of the skin disappeared. The patient is living, and there has been no recurrence of the tumor almost three years later.

value, and in some cases considerable regression and partial recalcification have been obtained.

Cancer of the breast has been found to respond well to roentgen therapy. Quick (6) reports a case of cancer of the breast that was treated with the roentgen rays alone, and is living and clinically well for 14 years. In our experience roentgen therapy has been used chiefly in post-operative cases after metastasis had developed. From 1922 to 1933, a period of 11 years, 148 patients were treated for cancer of the breast. These can be divided into the following three groups. Group I, post-operative, consisting of 130 cases. The majority of the patients in this group were referred for deep therapy after metastasis had developed: the average duration of life of 67 per cent of them was two years. The percentage who lived for three years or longer was about 33 per cent. Group II, 15 cases, all of whom were inoperable and with metastasis. Their average duration of life was 15 months. Group III, 3 cases, all of whom had primary operable cancer of the breast. This latter group while small in number is of the greatest interest. In this group, one patient was under observation for 18

months, another two years, and a third almost three years. These patients, who received no other treatment excepting roentgen therapy of 200 K.V., responded excellently to radiation. The tumor in the breast and the enlarged axillary glands rapidly disappeared, and up to the present time there has been no recurrence.

One particularly interesting case, living almost three years since treatment and clinically well so far as the breast is concerned, is here reported.

Case 1. White, aged 62 years, married, had a large ovarian cyst removed six years ago. The clinical history was otherwise essentially negative. Roentgenograms of the skull, chest, spine, and pelvis were negative for metastasis. However, the chest revealed dilatation of the arch of the aorta and an enlarged heart. The patient was seen in the early part of December, 1931, by Dr. Bloodgood, who found on examination a retraction of the right nipple, and edema of the skin, with red streaks on it to the inner side of the nipple. There was a lump in the breast and a palpable lymph node in the right axilla. The diagnosis was a large infiltrating scirrhous carcinoma of the right breast, clinically malignant because of retraction

of the nipple and tumor. It was pronounced carcinoma dermatitis, beginning carcinoma *en cuirasse*. The left breast

breast practically disappeared as well as did the tumor: also, the nipple began to reform. Three months later, a second course



Fig. 3. Case 2. Large metastatic retroperitoneal sarcoma three months after surgical removal of the right testicle for embryonal type sarcoma. Pressure of this mass interfered with the filling of the pylorus and duodenum and displaced the transverse colon downward. Following deep roentgen therapy, the tumor disappeared. The patient is clinically well, there having been no recurrence of the tumor after eleven years.

had a mass of the mastitis type in the center beneath the nipple and areola. There were no palpable lymph nodes in the left axilla. The patient was treated through the following four portals of entry: anterior; posterior; right and left lateral, covering both the breasts, axillæ, supraclavicular region and the mediastinum, receiving 625 r units over each portal or a total of 2500 r units. Soon after treatment the erythema of the right

of 2500 r units was given similar to the first. At this time the nipple had reformed and the tumor in the breast and the lymph node in the axilla had completely disappeared. In answer to a follow-up letter, the patient writes under date of Aug. 24, 1934, as follows: "My right breast seems perfectly normal, never giving me any trouble whatever. My heart is giving me some trouble." Sampson Handley (7) states that 70 per cent of all

patients coming to operation have intra-thoracic involvement. Surgery, radium, and the roentgen ray are all used in the treatment of cancer of the breast and a combination of all three has to be used in certain cases. Cancer of the breast is a radiosensitive tumor and in my experience the roentgen ray offers much alone. In the few cases of primary cancer of the breast in which I have used it alone, the results have been encouraging. It has an advantage over other methods in being able to cover a large field, being able to include at the same time and in one treatment the breast, mediastinum, and the lymph nodes.

As a rule, the more malignant the tumor the more radiosensitive it is likely to be, for example, lymphosarcoma, Hodgkin's disease, and embryonal cell tumors. Tumors of the testicle (embryonal cell type) are especially radiosensitive and highly malignant, frequently metastasizing to the abdomen. There are, however, exceptions as to their curability, the following case being an example.

Case 2. White, male, aged 42 years, married, entered the hospital in July, 1923, complaining of pain in the right lumbar region which radiated to the right ureter. On examination, the left testicle was found to be apparently normal: the right testicle was absent. There was a large spherical mass in the abdomen which seemed to be fixed and very rigid. When palpating the kidney area on either side, the mass was near the mid-line and did not move. Roentgen examination of the chest was negative. Roentgen examination of the gastro-intestinal tract revealed difficulty in filling the pylorus and duodenum due to pressure of an extra-gastric tumor and displacement downward of the transverse colon due to pressure. An exploratory operation revealed a large mass, nodular in character, beneath the peritoneum. There was no glandular enlargement. It was impossible to move this mass freely or

to trace a direct communication with the kidneys. The mass seemed so large and so near the large blood vessels, that it was considered inadvisable to attempt to remove it. No glands could be obtained for diagnosis. From the previous history the mass was thought to be a malignant metastatic tumor, although it was impossible to obtain a section. A section from the right testicle removed in March, 1923, revealed an embryonal type sarcoma.

The patient was given deep roentgen treatments over the abdomen through several ports of entry during the months of August, September, and October, 1923, and also in October, 1924, but none since. The mass in the abdomen had completely disappeared and the patient was clinically well following the last treatment. He was seen five years later and at that time there was no recurrence of the mass and he was clinically well. In reply to a follow-up letter the patient writes on Aug. 16, 1934, now eleven years since roentgen treatment, as follows: "I feel well and am able to attend to my work. There is no recurrence of the tumor in my abdomen." This case illustrates an exceptionally favorable result obtained by deep roentgen therapy in a highly malignant metastatic tumor.

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THE TREATMENT OF EPITHELIOMA OF THE SKIN

By GEORGE E. PFAHLER, M.D., Sc.D., and JACOB H. VASTINE, M.D., Philadelphia

THE treatment of epithelioma of the skin is a subject that cannot be ignored even though it involves the form of cancer that is most easily controlled. There are still approximately four thousand deaths from cancer of the skin in the United States each year, a total and absolute waste of life for which there is no reasonable excuse. Forty years ago, the cure of a cancer of the skin was a real accomplishment.

cancerous lesions and the early cancers skillfully and thoroughly from the beginning so as to prevent the development of cancer; or, if it has already developed when the patient comes under the care of a physician, so that the patient can be gotten entirely well and thus eliminate this type of quack.

The Treatment of Pre-cancerous Lesions.—It is general knowledge that cancer never begins in normal tissue, and certainly



Fig. 1. W. G., male, age 83, referred by Dr. W. H. Good, May 26, 1927, on account of an epithelioma involving the lower eyelid and extending toward the inner canthus, of four years' duration. Treated by radium surface application with thorough protection of the eye, eye lashes, and eyebrow: no scar. Well over seven years.

This report is based upon a study of 1,713 epitheliomas of the skin occurring in 1,385 private patients treated during the last 34 years. Of this number, 17 patients died of the cancer, we believe because they came too late. *To-day if all the knowledge that is now available is utilized skillfully, practically all cancers of the skin can be prevented, and if they are treated reasonably early, while the disease involves only the skin, practically all of them should be cured.* This fact is not sufficiently appreciated.

Among the laity, cancer of the skin is just as much cancer as is that involving any other part of the body, and the quacks usually get their following and make their money from an occasional cure of cancer of the skin. Therefore, it is most important that the medical profession treat the pre-

we have never seen any cancer that we believe originated in normal tissue. Fortunately the skin is an organ that can be easily observed by the patient and by the physician. The slightest roughness of the skin is usually noticeable by the patient, but because of the fact that there is practically never any pain or marked disturbance at the beginning of these lesions, they are frequently ignored.

Cancer of the skin nearly always develops very slowly and insidiously, so that the difference between one month and the next is not great. This fact develops in the mind of the patient a sense of indifference or security. We believe, however, that it is the duty of the physician to advise the patient to have any lesion of the skin restored to normal as promptly and as thoroughly as is possible.

Moles, and particularly the pigmented moles, may occur singly or in large numbers on a patient. They may have been

thesia at one sitting by dissection or electrocoagulation if skillfully done. If they are not already too deep, the scar follow-



Fig. 2 (above). S. E., female, age 85, referred by Dr. J. L. Flanigan on June 20, 1927, on account of advanced basal-cell carcinoma of the inner canthus and lower eyelid, of fifteen years' duration. Treated by surface applications of radium, with a perfect result. Well over four years: died at age of 90 without a recurrence.

Fig. 3 (below). C. H. H., male, age 64, referred by Dr. Lyman Hollingshead, Sept. 11, 1922, on account of an epithelioma involving the right temporal region (squamous-cell carcinoma). Treated by electrocoagulation and high voltage x-rays applied over the neck and temporal region. This has remained well to date but on Feb. 3, 1933, he developed an epithelioma of the left ear, with metastasis. This, too, has been treated successfully.

present early in life or may appear later in life, but we believe they are always congenital in origin. It is probably true that not more than one in a thousand, or at least one in a large number, becomes malignant, but when a pigmented mole does become malignant it is one of the most serious conditions with which we have to deal. If not treated most skillfully when the change from a benign condition to a malignant one occurs, extensive metastasis is likely to follow, and the patient is likely to lose his life. Therefore, it is probably best to remove all moles, but particularly all pigmented moles, as a precautionary measure.

Likewise, it is advisable to remove all warts and particularly senile warts, any abnormal crusts, fissures, or chronic ulcers. These can be eradicated under local anes-

ing is of little or no significance. Large scars after a period of twelve to fifteen years often develop epitheliomas, usually beginning as small fissures or erosions, then gradually spreading. This type of epithelioma is squamous-cell. Generally it is advisable to remove the entire scar by electrothermic dissection, and, if the wound is large, following that, after a period of about three weeks, by skin-grafting. Under these circumstances, we have had only one failure. Moles, warts and scars, and epitheliomas in scars are usually not successfully treated by irradiation alone, but are best destroyed by electrocoagulation.

Epitheliomas of the Skin.—Epitheliomas of the skin may occur as single or multiple lesions. However, they are usually single, and usually develop on the exposed parts

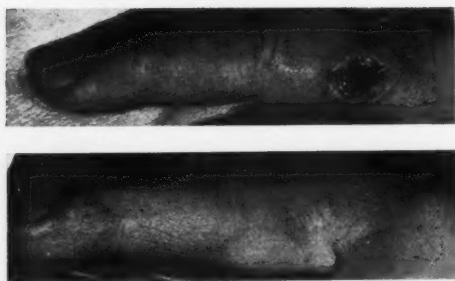


Fig. 4. A. G., male, age 54, referred by Dr. Samuel Bennett and Dr. J. V. Klauder, Nov. 21, 1928, on account of an epithelioma, squamous-cell type, affecting the right second finger, of five months' duration, associated with an enlarged lymph node above the right elbow. Destroyed by electrocoagulation, followed by high voltage x-rays covering the diseased channels all the way up to and including the axilla. Well at present over a period of five years.

of the body, but they may occur anywhere. It has been thought that epithelioma of the skin is practically always basal-cell in type. This is a mistake, for our records show approximately 15 per cent to be of the squamous-cell type, and it is well known that any squamous-cell carcinoma may give rise to metastasis. This fact must be kept in mind because in dealing with a squamous-cell type of carcinoma, one must not only treat the local lesion, but it is advisable to treat also the associated lymphatics.

The favorite locations for squamous-cell carcinomas of the skin are in the temporal region, the ear and its vicinity, the posterior surface of the hands, the genitalia, perineum, lip, and in any scar tissue, but this does not warrant us in concluding that all of these are squamous-cell nor that all other regions are not involved at times by squamous-cell carcinoma. For that reason, in practically all instances, we take a biopsy at the time of our treatment.

The treatment of epithelioma of the skin will depend in great part upon its size, depth, duration, and location. The records in the literature show that between 70 and 90 per cent of epitheliomas of the skin can be cured by irradiation, either with radium or x-rays, and this is undoubtedly the preferable method of treatment in any location where a slight scar is either objectionable or a serious matter.



Fig. 5. M. E. H., female, aged 75, referred by Dr. J. F. Pfahler, Dec. 27, 1927, on account of squamous-cell carcinoma involving the right wrist, of four months' duration. Removed by electro-thermic dissection and treated by high voltage x-rays over the entire arm and axilla. Well over two years: died of cardiac disease at age of 77.

Since we desire to have a biopsy, however, and providing the lesion is small and located at a point where a soft pink scar is non-objectionable, it is our custom to surround the lesion by electro-desiccation, do a biopsy, and then destroy the bed of the epithelioma completely, to be followed by a full erythema dose of x-rays, or surface applications of radium. By this procedure, in cases in which the epithelioma is still confined to the skin and has not invaded the muscle, fascia, mucous membrane, or bone, we expect to cure practically all, and our records show such results. This, therefore, is usually our primary form of treatment, but if the biopsy shows squamous-cell carcinoma, then we treat the neighboring lymphatic glands by filtered irradiation, and, according to the location, by high voltage x-rays. For this purpose, we give in divided doses not less than a total of 200 per cent of an erythema dose.

Multiple Epitheliomas (Bowen's Disease).—This subject will be dealt with later in a more detailed and specific study, together with the pathologic studies made

by Dr. Eugene Case, but briefly, it may be stated that in this multiple epitheliomas type, one may have on the same patient

mous-cell carcinoma of the multiple type and developed metastatic lesions from which he died.



Fig. 6 (above). M. L., female, age 75, referred by Dr. Robert Parrish, Sept. 21, 1922, on account of an epithelioma on the right upper lip. The lesion had been growing for twenty years, but especially during the last two years. Size, 3.5×4.5 cm., and 2.5 cm. in thickness; it was beginning to ulcerate. Removed by electrocoagulation followed by x-ray treatment over the lip and side of neck. Well two years at time of death from another cause at age of 77.

Fig. 7 (below). E. F., female, age 46, referred by Dr. Peter F. Moylan, Jan. 18, 1926, on account of basal-cell carcinoma of the rodent ulcer type (seventeen years' duration) of the right temporal region. Treated by radium applications, then by electro-thermic dissection and further radium treatment. Patient is well to date after a period of eight years.

one hundred or more epitheliomas, and one may find lesions varying from the size of a pinhead to the size of a fist. This type, multiple epitheliomas, develops very slowly: in one of our cases, the patient had lesions for forty years, and they varied from a few millimeters to the size of a fist. Under general anesthesia, we removed on one day 98 of these lesions, followed by complete and permanent recovery. Fortunately, this type is usually slow in development and is nearly always basal-cell in type, but one of our patients with these multiple epitheliomas had squa-

The Basal-cell Epitheliomas Are of Two Types.—In one group the typical lesion seems to develop as a papilloma, which may be small or become enormous in size. The second group shows very little overgrowth of tissue or papillomatous condition, but does show ulceration, and this represents particularly the group which has been called *rodent ulcer*. These rodent ulcer types, if treated early while they still involve only the skin, are easily cured by radium, x-rays, or electrocoagulation, but when the rodent ulcer type of epithelioma has extended into the muscle, bone, carti-

lage, or fascia, it becomes a most resistant and persistent type of disease to treat. One can often arrest these cases completely

tory reaction about the bone. At such times it is usually possible to grasp the sequestrum with a pair of Rongeur forceps

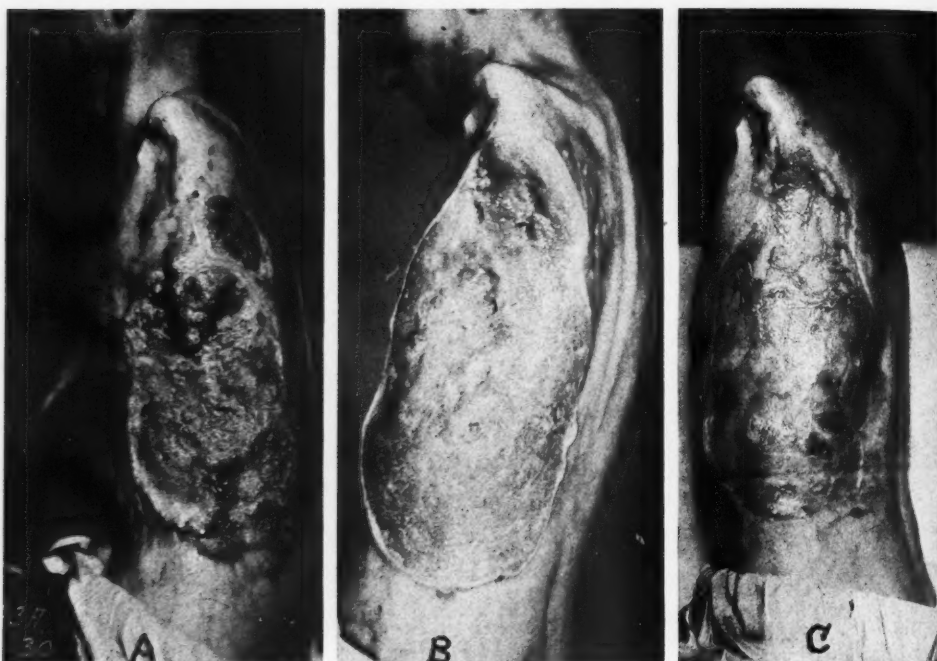


Fig. 8. R. D., male, age 38, referred by Dr. George Reese, March 24, 1930, on account of extensive carcinoma involving the remnant of the left shoulder and entire left side of the chest and upper abdomen, following a severe burn twenty-five years previously, due to explosion of a chemical torch. In 1925 Dr. Reese did a disarticulation of the shoulder. The wound never healed. Recurrent carcinoma was removed in December, 1929. A recurrence was again removed March 1, 1930. In association with Dr. William Bates, we removed the entire diseased area (Fig. 8-A) by electro-thermic dissection, together with resection of a portion of the brachial plexus. The disease was found to be squamous-cell carcinoma, Type II. The entire area was treated by radium packs. The wound is shown in 8-B. After thorough irradiation treatment the wound was grafted with skin by Dr. Bates, with success, but the patient died Sept. 20, 1931, or approximately one year and a half after beginning treatment, from metastasis to the ribs and to the pleura.

by irradiation. At other times, the lesion is arrested for one year, or for several years, and then may recur. Generally speaking, it has seemed best to use electro-coagulation in this type of case, to destroy the lesion completely. Even if bone is involved, the bone area should be destroyed, and then the area destroyed should be resected down to healthy bone. If resection immediately is not practical, one may allow the destroyed bone to separate gradually from the surrounding bone, a matter which usually takes from three to six months and is indicated by an inflamma-

and lift the entire bone away. In this manner, we have removed the entire alveolar process of the lower jaw, leaving apparently a smooth and healed surface underneath.

When dealing with these deep rodent ulcer types of epithelioma of the skin, the deep involvement and erosions are usually in the neighborhood of the mastoid process, the superior maxilla, the orbit, or the nose, and in these areas it is difficult to do extensive resections. Therefore, at times, it has been our practice to destroy the disease, and then wait for the separation

of the dead bone. Certainly, with the present state of knowledge and skill, there should be fewer patients with such advanced disease. In the treatment of any case of epithelioma, as in the treatment of carcinoma anywhere in the body, we cannot lay down a definite rule of procedure. The plan of treatment should be adapted to the individual case, and one should keep in mind the general principles of preserving as much normal tissue as is possible to eliminate the disease as thoroughly as possible with the least loss of time, the least involvement of expense, and the least discomfort or suffering on the part of the patient.

X-ray and Radium Treatment.—When one treats an epithelioma of the skin by means of either radium or x-rays, it is usually necessary to give a total of from four to ten erythema doses. The failures are usually due to insufficient treatment, or to a very prolonged treatment with insufficient dosage, a procedure which leads to the formation of much fibrous tissue embedding a few vital cancer cells. These cells later take on new growth, which explains the temporary cures and late recurrences.

If the lesion is small, one can safely give from four to six erythema doses at one sitting or at least within a few days. If the lesion is large, one must often use smaller

doses, but even then the treatment should be given within from three to six weeks. *Each case must be dealt with according to the conditions present.* One can discuss only general principles.

Good results have been obtained with soft rays and no filter, but I believe there are likely to be more recurrences when soft rays are used. We commonly use from one to two millimeters of platinum on radium even for skin cases, especially about the eyelids and inner canthus. The inner canthus lesions are markedly treacherous.

If these principles are kept in mind and we let the general public know that practically all these skin cases can be cured by the physician, or at least by a physician who is specializing in this work, then the quack will soon lose this field, and we will develop more and more prestige for the good of the profession. It is the fear of operation which, to the patient's mind, means cutting, blood, dressings, hospitalization, etc., which keeps him from coming to the physician early for the treatment of any tumorous condition. Let us eliminate this fear and we will then have an opportunity to advise the patients according to the condition present, whether it be radium, x-rays, electrocoagulation, operation, or one or more of these procedures combined.

RADIATION THERAPY IN CARCINOMAS OF THE UTERINE CERVIX¹

By HENRY SCHMITZ, A.M., M.D., LL.D., F.A.C.S., F.A.C.R., *Chicago*

From the Department of Gynecology of Loyola University School of Medicine and the Mercy Hospital Institute of Radiation Therapy, Chicago

THE five-year good end-results of radiation treatment in carcinomas of the uterine cervix are contingent on the size of the growth and on an adequate radiation dose. The histologic malignancy index and the constitutional or systemic reaction, also, influence the percentage of good end-results. However, the relation between these last factors and the results of treatment has not as yet been definitely confirmed. The extent of the tumor and the technic of radiation therapy and their influence on the five-year good end-results will be briefly described.

The extent of the growth is expressed in four clinical groups:

Clinical Group 1.—The clearly localized growth. It is on an average about 1 cm. in diameter in all directions.

Clinical Group 2.—The doubtfully localized growth. It is characterized by an edema or infiltration of the paracervical connective tissue and hence a decrease in the degree of downward displacement of the uterus.

Clinical Group 3.—The invasive growth. It is marked by definite invasion of the parametria or regional lymph nodes, but the invaded structures are movable, though movability is decreased, due to loss of elasticity of the tissues of the parametrium.

Clinical Group 4.—The fixed and terminal growth. It is distinguished by fixation of the tumor, due to invasion of the deep visceral and parietal pelvic fasciæ, or invasion of the vagina, urinary bladder or rectum, or the formation of distant metastases.

The clinical grouping is used in most of the gynecologic clinics in the United States of North America. It is based entirely

on the clinical findings and prevents a subjective interpretation of the extent of the growth. The terms "operable," "borderline," and "inoperable" carcinomas lead to subjective interpretations varying with the surgical judgment and technical ability of the gynecologist.

An adequate radiation tissue dose means a homogeneous impregnation with a predetermined radiation dose of the entire true pelvis. The tumors of Clinical Groups 1, 2, and 3 are confined within the true pelvis. The limits of the radiation dose are set by the tolerance of the normal tissues and by the quality of the roentgen rays.

The tolerance of the normal tissues has been termed the "Tolerance Skin Dose" (Tol.S.D.). The threshold skin dose produced with 200 K.V. maximum is 600 r with back-scatter. The erythema skin dose produced with the same dose of roentgens is 900 r with back-scatter. The tolerance skin dose used in our work and applied with the same roentgen dose is 1,350 r with back-scatter. The doses should be given in one sitting. If fractionation is employed, using ten equal fractions every other day to a field, then the total dose of 2,700 r with back-scatter may be applied to produce a tolerance skin dose. Hence it is evident that the distribution of roentgen dosage through two fields in a patient with an anteroposterior pelvic diameter of 20 cm. is practically 1,500 r if applied in one sitting, and 2,700 r if applied within 21 days, giving to each field ten fractions of 250 r plus every other day, thus attaining about 3 Tol.S.D. in the midpelvis. However, about 4.5 to 5 Tol.S.D. constitute an adequate tissue dose for uterine carcinomas. The deficiency is supplied by the intracervical insertion of 50 milligrams of radium ele-

¹ Read at the Fourth International Congress of Radiology, Zürich, Switzerland, July 24-31, 1934.

ment for 32 hours, filtered with 2.0 mm. brass and 3.0 mm. para rubber, thrice at eight-day intervals or 4,800 mg.-el.-hrs., while the application of a single dose would be 3,600 milligram-element-hours. The distribution of gamma ray intensities is, however, very inhomogeneous. Within a radius of 3 cm. from the axis of the cervix the combined roentgen and gamma dose is 4.5 Tol.S.D. and at the bony pelvic

wall about 3 Tol.S.D. It follows that a carcinoma within a radius of 3 cm. can be destroyed in the majority of cases, but beyond this radius it is only exceptional that a good end-result may be attained.

The correctness of these statements concerning adequate radiation dosage has been proven by the study of the five-year good end-results obtained in each of the clinical groups. (See Table II.)

TABLE I.—FACTORS USED IN ROENTGEN TREATMENT FOR EACH APPARATUS EMPLOYED

Periods	1914-1919	1920-1921	1922-1923	1924-1932	Since 1933
Transformer	Snook Cross-arm	Type A.C.	Cross-arm Type A.C. to deliver 280 K.V. (max.)	211	Pulsating current to deliver 800 K.V. (max.) 800
Kilovoltage (max.)	110	140	211	211	211
Type of Tube	Standard Coolidge with broad focus	Coolidge with broad	Air-cooled 200 K.V. Coolidge	Water-cooled 250 K.V. Coolidge	Water-cooled four section Coolidge
Filters	6 mm. Al	0.5 mm. Cu + 1.0 mm. Al	1.0 mm. Cu + 1.0 mm. Al	1.0 mm. Cu + 1.0 mm. Al	1.5 cm. water 1.5 mm. brass 2.0 mm. Al 1.0 mm. Pb 3.0 mm. Cu 1.0 mm. Al 5.0 mm. bakelite 7.7 mm. Cu
H.V.L.			1.2 mm. Cu	1.85 mm. Cu	7.7 mm. Cu
F.S.D.	25 cm.	65 cm.	65 cm.	80 cm.	75 cm.
Size of Field	5 × 5 cm.	15 × 15 cm.	15 or 20 × 20	15 or 20 × 20	15 or 20 × 20 or 25 cm.
Number of Fields	8 to 20	2 to 5	2 to 5	2 to 5	2 or 3
Ma.	5	5	5	25	10
Fractions	3	3	0	5 to 10	10
Intervals	3 days	3 days		2 days	2 days
Depth Dose at 10 cm.	20%	32%	44%	46%	54%
r with back-scatter to each field		750	900	1,500 with 5 fractions 2,500 with 10 fractions	10 × 280 r

TABLE II.—THE FIVE-YEAR GOOD END-RESULTS FOR EACH CLINICAL GROUP AND PERIOD IN PRIMARY CARCINOMAS OF THE UTERINE CERVIX

Period	1914-1919					1920-1921				
Clinical Group	1	2	3	4	Total	1	2	3	4	Total
No. admitted	5	16	76	35	132	9	13	26	29	77
No. 5-year end-results	5	7	7	0	19	6	6	2	0	14
Percentage 5-year end-results	100.0	43.75	9.21	0	14.39	66.67	46.75	7.69	0	13.38

Period	1922-1923					1924-1929				
Clinical Group	1	2	3	4	Total	1	2	3	4	Total
No. admitted	9	19	59	36	123	23	36	100	116	275
No. 5-year end-results	7	7	11	0	25	21	19	30	7	77
Percentage 5-year end-results	77.78	36.84	18.65	0	20.32	91.3	52.78	30.0	6.04	28.0

Grand Total, 1914-1929					
Clinical Groups	1	2	3	4	Grand Total
No. admitted	46	84	261	216	607
No. 5-year end-results	39	39	50	7	135
Percentage 5-year end-results	84.77	47.62	19.16	3.24	22.26

Another observation resulted from this study. The number of five-year good end-results increased with an improvement in the roentgen apparatus and tubes, as seen from Tables I and II. The radium technic of application has remained the same throughout the years. Therefore, increase in the absolute percentage of the five-year good end-results should be attributed to the progress in the development of roentgen and tube equipment and technic of application. The installation of an 800 K.V. (max.) transformer should improve the five-year good end-results so far attained. The factors used in the application of the 800 K.V. roentgen dose are seen in Table I.

The fractionation of the treatment could

not account for the gradual improvement of the results, as we have practised fractionation in radium and roentgen therapy since 1914. Protraction was found to be not necessary in carcinomas of the uterine cervix. The daily application of radiations, either radium or roentgen, over 24 to 30 days assures the best and continuous distribution of electrons within the tumor-bearing area.

The substitution of the "tolerance tissue dose" for the threshold or erythema skin dose and the improvement of apparatus and tubes—and hence technic of treatment and more favorable distribution of radiation intensities—are some of the main factors to be considered in radiation therapy of uterine cancers.

NEW ENCEPHALOGRAPHIC TECHNIC: INSUFFLATION OF AIR BY THE DOUBLE PUNCTURE METHOD—CISTERNAL AND LUMBAR COMBINED¹

By DR. MARIANO R. CASTEX, Member of the Academy of Medicine and Professor of Clinical Medicine, and DR. LUIS E. ONTANEDA, Venia Docenti of Clinical Medicine and Chief of the Clinical Service at the Central Military Hospital, *Buenos Aires, Argentina*

IN ONE of our previous papers (Castex and Ontaneda, 1932), we pointed out the serious inconveniences brought about by the technics used up to the present for the insufflation of air for encephalographic purposes. In synthesis, we could state that the fundamental principles generally used for such technics, with a view to causing the least possible change in the endocranial pressure, are based on two different procedures:

1. To inject approximately the same amount of air as corresponds to the quantity of cerebrospinal fluid having been extracted.

2. To insufflate as much air as is necessary to keep the lumbar tension at the end of the operation at the same level as it was before the operation.

With the exception of a few authors who make use of more or less ingenious apparatus, tending to avoid the sudden tension changes during the substitution of liquid for air, the majority employ a simple syringe which draws in the liquid and insufflates the air. Those using this procedure come to face sudden tension changes with every extraction of liquid and with every injection of air.

But, even if we suppose that the use of an ideal apparatus or appliance would eliminate the sudden changes, by the lumbar method, the insufflation will not take place without having generally caused a tremendous hypertension in the endocranium. In fact, it is well known that the pressure of the liquid, when we consider a patient as standing up or sitting, is so much less as a higher region is considered. We can briefly say that in such a position

the normal patient has the following approximate tension:

Ventricular: -10 cm. of water
Cisternal: -0 cm. of water (3)
Lumbar: +40 cm. of water.

So, even when using what seems to be the ideal technic (constant maintenance of the initial lumbar tension during the insufflation), as soon as the operation is finished there takes place a tremendous hypertension. Let us suppose that we have extracted the whole amount of liquid and substituted air. Having done this, we have placed the whole ventricular-subarachnoid space at the tension similar to the initial lumbar tension, that is, 40 cm. for the example we have in mind. That is to say, the ventricles are subjected to an air pressure of 40 cm., or 50 over the initial reading, and, in fact, so tremendous as would most certainly not be produced by the largest tumor. Naturally, by failing to completely drain all the liquid out of these spaces, pressure changes will be less noticeable, but nevertheless of considerable importance.

To sum up, we can say that the causes that bring about disappointments and inconveniences by insufflation of air, in order to secure encephalograms, are subjected to the following:

1. The same presence of air which produces a meningeal and ependymal irritation, independent of its pressure;

2. The sudden pressure changes, when extracting cephalo-rachidial liquid and insufflating the air;

3. The heavy cranial hypertension caused by the exchange of liquid for gas.

Insufflation by the cisternal method is less dangerous and less bothersome inasmuch as, the sub-occipital tension being so

¹ Presented before the American Congress of Radiology, at Chicago, Sept. 25-30, 1933.

much more like the ventricular than the lumbar, the final air pressure obtained is similar to the initial one of the cephalorachidial liquid in the endocranium. And as the vital centers are to be found in the

operation the cranial tension is nearer to the primitive value than when working by the lumbar method, the tensional disturbances with every extraction-insufflation will be greater due to the larger amount that has to be drawn with the syringe with every manipulation.

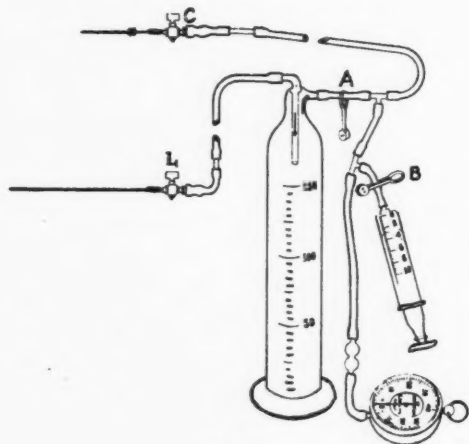


Fig. 1.

encephalus and not in the spinal cord, it will be understood why we should concern ourselves with the maintenance of a constant or almost constant ventricular tension rather than the lumbar.

But the methods commonly used for the insufflation of air by the cisternal method, based upon the extraction of liquid and the injection of air, as when the operation is done by the lumbar method, have the serious inconvenience of occasioning tremendous tensional oscillations in every replacement of liquid for gas. Furthermore, it is constantly observed that after injecting 10 to 15 c.c. of air, the following drawings made by the syringe secure liquid only after a certain amount of air has entered in it, inasmuch as the air fills the cisterna magna before passing into the endocranium. It is worth while to mention that in the successive exchanges it becomes necessary to draw as much as 20 c.c. in order to obtain from 5 to 8 c.c. of liquid. The balance (15-12 c.c.) corresponds to the air that returns to the syringe and has to be re-injected. Therefore, if toward the end of the

OUR EXPERIMENTS

For the last six years we have been practising encephalography by cisternal procedure, after having forsaken the lumbar method due to the serious accidents resulting from it. At first we used the common technic, removal of liquid or injection of air, and although neither one completely satisfied us, to do so turned out much better than to use the lumbar procedure inasmuch as the patient could stand it better, and we found it necessary to use a smaller amount of air in order to secure satisfactory encephalograms.

We have tried at various times to improve the technic. Once we tried to insert two needles into the cistern. One of them was used in conjunction with a 20 c.c. syringe for the injection of air, and the other was attached to a rubber tube, ending in a shorter one made of glass. Both were filled with physiological serum and were raised or lowered so as to avoid the leakage of serum to the outside or into the cistern. In other words, the serum level was set at the necessary height in order to neutralize the pressure of the liquid within the cistern. Air was injected with a syringe. Cisternal tension was increased, and, under this condition, first serum and then the liquid would pass through the tube and come out by the free end of it until the equilibrium of the primitive tension was obtained without greatly changing the tension in the endocranium. We forsook this procedure because soon after the passage of the liquid, air would begin to leak from the tube, due to the fact that, as we mentioned before, the air is first concentrated in the posterior cistern before passing into the endocranium.

When this procedure failed, we adopted another one. Considering that in the cis-

terna magna there is always a lesser tension than is to be found in the lumbar (in normal persons at this high level, while sitting, the tension is either negative, up to 5, null or positive, up to 5 cm., practically null), we made a double puncture, lumbar and cisternal. The liquid would flow through the lumbar needle, while the ambient air would automatically pass through the cisternal needle, inasmuch as the loss of lumbar liquid would cause cisternal hypotension, which, in turn, would "inhale" the atmospheric air, thus keeping the cisternal tension even with that of the atmosphere. This procedure is advisable only in patients whose cisternal tension is very close to normal, that is to say, 0, or the same as the atmosphere. In patients with a negative tension, this is increased to 0. This inconvenience does not amount to anything; on the contrary, in hypertensive patients, it is necessary to allow the flow of cisternal liquid until the cisternal tension equals that of the atmosphere. It will be understood that it is a serious inconvenience when we are dealing with cerebral tumors. Therefore, this procedure is advisable only for non-hypertensive patients.

After further trials, which we choose not to describe in order not to lengthen this paper too much, we reached what seems to us to be the definite conclusion, and which we shall now proceed to explain.

PROCEDURE

We have already stated that at the level of the cisterna magna there is always a lesser tension than the lumbar, while the patient is standing up, no matter what the value of endocranial pressure may be. Then it will be understood that if two needles are placed in combination, one inserted deeply into the lumbar cavity and the other into the cistern, with a container filled with air, the lumbar liquid, due to its higher pressure, will come into the container, thus dislodging the air in it, which automatically will ascend through the tube connected to the upper needle. It will then pass into the cistern, and from here to



Fig. 2.

the endocranium. The amount of lumbar liquid passing into the glass container will be similar to the amount of air emanating from it and passing into the cistern, without the necessity of removing one nor insufflating the other.

In order that the cisternal tension shall be maintained constant during this operation, it is necessary that, before the lumbar liquid comes out, the air in the container must have the same pressure as the cistern. In this way the whole system will function at a constant tension, subjected to minute changes which are practically disregarded during the course of the operation.

Apparatus.—During practice, a glass container or, still better, one of the small

ampules (150 to 200 c.c.) used for physiological serum, has been found to be satis-

physiological serum in that it is elongated, graduated from 10 to 10 c.c. up to 150

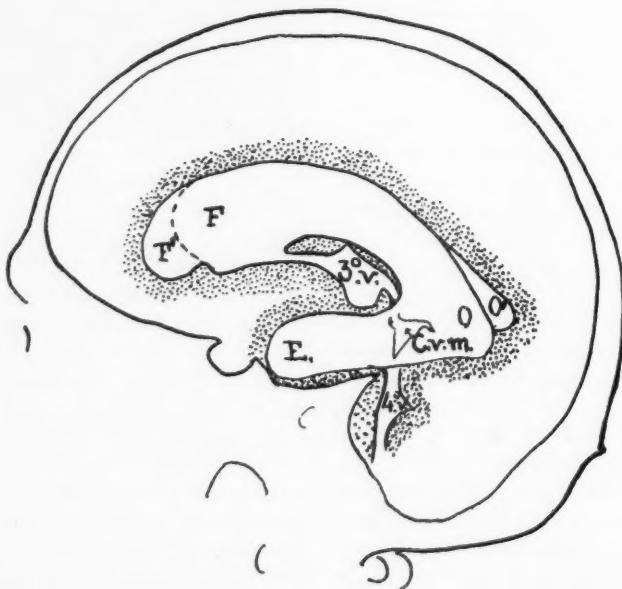
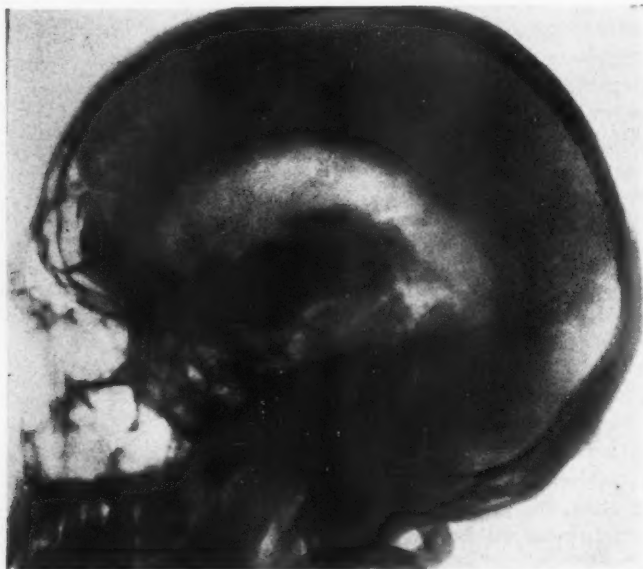


Fig. 3.

factory. We ordered a special ampule which differentiates from those used for

c.c., and the tube, which continues one of its two openings descends from the neck of

the bottle, down to a level just above the top of the graduate scale, so that the dripping of the fluid can be seen (Fig. 1). The outlets of this ampule are connected to the tubing which runs to the needles. The rubber tube corresponding to the lumbar needle (*L*) is connected to the outlet which prolongs itself into the container. The rubber tubes, measuring 30 to 35 cm. for the lower needle and from 60 to 70 for the upper, are connected to large manometers by means of "T" glass connectors. One of these instruments registers the lumbar tension, while the other registers the cisternal tension. In fact, practice calls only for the cisternal manometer. For this purpose we make use of a special manometer² which registers both the positive tension (up to 40) and the negative (up to 30) in centimeters of water. When this manometer cannot be had, simply use Claude's instrument, which although it does not register the negative tension, does register the true tension when it is most desired; that is, whenever there is any cranial hypertension. The tubing leading to the cisternal manometer is provided with a "T" connector (*B*) by means of which a syringe can be attached to the system. Whenever it becomes necessary to interrupt the passage through the needles, this can be done by means of the two petcocks (*C* and *L*), or otherwise, by making use of two Mohr's forceps.

Technic.—After the routine sterilization of materials by boiling, the operation is started. Having duly prepared the patient with the aid of the anesthetics and other sedatives commonly used (and if he has cranial hypertension he should be given the generally used hypertonic solutions), he is seated on a chair in such a way that the chest rests against the back of it. The rubber tubes are connected to the glass container, and then the procedure is as follows:

1. Make the lumbar puncture on the point of choice and connect the needle to the petcock *L* before perforating the dura,

so that no liquid will escape. Petcock *L* should be closed.

2. Then make the cisternal puncture³ and connect the corresponding needle to the open petcock *C*, while the passage to the container is interrupted by means of forceps *A*. In this way the manometer will register the cisternal tension.

3. In order to obtain within the container a tension similar to that of the cistern, we must proceed as follows: Isolate the cistern by closing petcock *C*. The glass container is then directly connected to the manometer and syringe by releasing the forceps *A* and *B*. With the syringe air is either withdrawn from or injected into the bottle, as the case may be, till the tension in it equals that of the cisterna magna. Then, by opening petcock *C* a direct connection is established between the cistern and the manometer and glass container.

4. By opening petcock *L* a closed circuit is established between the bottom of the lumbar cavity and the cistern; the cerebrospinal fluid passes through *L* and goes into the container by replacing the air in it and expelling it toward the cistern, from which place it goes into the endocranium, without altering the cisternal tension, as can be seen in the manometer.

5. Then, slowly, the desired amount of liquid is allowed to flow into the glass container; generally about 50 c.c. is sufficient. A similar amount of air is allowed to go into the cistern. It has been found convenient to close petcock *L* every time 15 or 20 c.c. of air has passed through, so that the air penetrates slowly into the ventricles.

An increase in tension as registered by the manometer can be caused by: (*a*) the patient's efforts due to discomforts;

³ In order to make the cisternal puncture we apply our own technic which allows one: (*a*) to outline exactly the point of entry; (*b*) to determine in each case the skin-dura mater distance, that is, the length of needle to be inserted; (*c*) to show the exact direction in order to reach, straight and exactly, the occipitotrochlear space, and to show at any time the exact location of the end of the trocar within the tissues it traverses.

² Manufactured by Boullite, of Paris

(b) the existence of a small amount of water in the cisternal tubing which disturbs the air advance; (c) the fact that the cisternal needle is not *in situ* or has come out of its place. This last occurrence is immediately detected; in fact, in the first two instances there has been a slight increase, while in the last one the increase lasts for some time, and continues the upward trend until the pressure within the container is so great that it stops the extraction of lumbar liquid. Under this circumstance it will suffice to re-insert the end of the needle in its place, and at once it will be noticed that the tension is coming down to its original value.

6. When the insufflation is finished, proceed to close petcock *L* and then withdraw the needles, to be followed by the taking of radiographs after a lapse of about an hour for better results (thus allowing for the maximum penetration of air into the ventricles).

Results.—It will be seen that during the course of the operation there occur no tension changes at a level with the cistern, and whenever all the technic requisites have been fulfilled, the oscillations of the cisternal manometer are practically depreciated, as they are not more intense than the physiological ones generally observed. However, as it is logical to expect, the lumbar tension begins to descend as the liquid is drawn out, inasmuch as its height along the column diminishes in the dural sac. By drawing out a small amount of liquid, this lumbar tension descent will be very slight and can always be depreciated, since, what really interests us is not to maintain a constant pressure on the spinal cord, which lacks vital centers, but, rather, to uphold it wherever those centers exist, that is, in the ventricular walls and in the endocranium in general.

Up to the present time we have done about a hundred encephalographies by this method (25 on patients with cerebral tumors, and some of them in the posterior cranial fossa), without having to record up to this time any regrettable developments

that could be blamed directly on the operation.

During the insufflation the discomforts and objective symptoms are light, when compared with what we are accustomed to see when the common technics are used. Although cephalæas are ever present, they are less intense, while at the same time it is impossible to suppress them wholly, due to the fact that in part they are derived from the irritating action of the air. Such common phenomena as vomiting, perspiration, etc., are less frequently noted. Radiographs are easily obtained, due to the better tolerance of the patients.⁴ The post-operative period offers a little more discomfort than generally is noticed under the common rachicentesis, but the patient is mostly able to get up between the second and fourth days after the operation. We have never seen any disagreeable sequelæ, but instead we have recorded improvements or cures, as other authors have described, as a result of air insufflation.

The radiographs obtained leave nothing to be desired. The filling of the ventricles and of the subarachnoid spaces has been accomplished with the efficiency expected from the usual technics. In short, we believe that our technic offers the security of ventriculography, with the simplicity of encephalography.

SUMMARY

1. The insufflation of air by lumbar procedure, according to the methods used up to this time, causes intense endocranial tension changes, thus accounting for intense subjective discomfort, and very frequently causes serious and sometimes fatal accidents. Although it seems that the technics employed are quite perfect, there constantly develops an intense endocranial hypertension.

⁴ With a view to disturbing the patient the least, and injecting strictly the necessary amount of air so that the most desirable radiographs are obtained, one of us (Ontaneda) has designed a chair which allows the satisfactory fulfillment of all the requisites involved. The description of this chair will be presented in a separate paper (Fig. 2).

2. We hereby submit a technic based on the existing difference of tension between the fundus of the dural cavity and the cisterna magna, when the patient is sitting up.

3. The principle of this method is that, if a glass container filled with air is connected to a needle inserted into the cistern and another needle in the dural cavity, the lumbar liquid will pass into the glass container due to its higher pressure, will dislodge the air harbored in it, and then will send this air into the cistern and finally into the endocranium, without practically altering the endocranial tension.

4. The results obtained by this method in about a hundred cases are very satisfactory, and we believe that it is just as much

or more innocuous than ventriculography and much more than encephalography, thus compensating for its greater technical complexity.

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CHANGES IN THE LUNGS AND PLEURA FOLLOWING ROENTGEN TREATMENT OF CANCER OF THE BREAST BY PROLONGED FRACTIONAL METHOD¹

By HARRIET C. MCINTOSH, M.D., *New York City*

THE recognition of the condition of pleuropulmonitis following roentgen treatment of the thorax for cancer of the breast and intrathoracic malignancies is not new. The condition was first definitely pointed out by Groover, Christie, and Merritt in 1922 (1), but the descriptive term "pleuropulmonitis" by which it is now best known was first applied by Desjardins (2). In the five years between 1922 and 1927 a considerable number of papers and discussions were contributed on the subject (3). The thought was at first expressed that the growing number of cases, where none had been previously reported, was related to the use of copper filtration, with the greater depth dose resulting. The first commentators used an average of 135 K.V.P. through 0.5 Cu. Tyler and Blackman (4), in the same year, used 6 mm. Al, as did Davis (5), and in 1925 Evans and Leucutia (6) reported intrathoracic radiation changes from both superficial and deep therapy, and stated that the quality of the rays had no influence, that the effect was a quantitative one only. Desjardins (2) and Groover, Christie, Merritt, and Coe (7) believe that the element of wave length has a very limited effect on the process and that the chief factor is quantitative. A review of the literature of the subject is not indicated here. Bibliographies are at hand by Davis (5) up to 1924, by Karlin and Mogilnitzky (8), and by Desjardins (2), up to 1932, the last being the most extensive. Neither this material nor my own search of current literature of the last two years discloses specific reports of lung changes arising from the employment of the prolonged fractional method, with high total r,

which has recently come into use for the treatment of inoperable mammary carcinoma. A few such cases, with careful depth dose estimations, will be presented herewith.

The importance of the subject rests upon two factors. First, there is the question of morbidity and possible mortality ensuing from these lung changes. This will be discussed later. Second is the difficulty of differentiating between radiation change and advancing metastasis, especially in cases in which more treatment for palliation of the metastasis might be contemplated. A curious feature of the situation is that although the condition is unhesitatingly recognized by many roentgenologists, it is almost categorically denied by others, quite regardless of the large number of animal experiments published, and a considerable body of clinical reports. I have heard two chiefs of large and active radiation clinics state that they have never in their own experience seen a case of radiation damage of lungs that they considered satisfactorily proved; that all cases in which they suspected radiation change, later turned out to be metastasis. A number of others have expressed various degrees of skepticism—this in the face of the fact that the technic of tangential radiation for carcinoma of the breast, devised by Holfelder and by Finzi for the avoidance of just such intrathoracic damage, is in wide use.

My material consists of eight cases treated in the Strang Clinic of the New York Infirmary for Women and Children, showing what I believe or know to be radiation changes in the lungs and pleura. However, one of these certainly, as shown at autopsy, and three more possibly, are complicated by the presence of metastases, so that I prefer to set them aside,

¹ Read in part before the Fourth International Congress of Radiology, Zurich and St. Moritz, Switzerland, July, 1934.

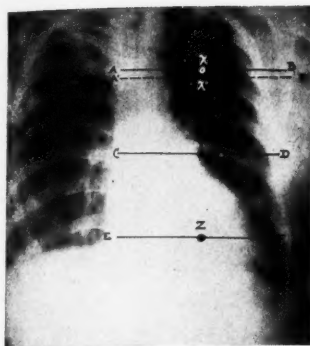


Fig. 1. Points chosen for estimation of depth doses.

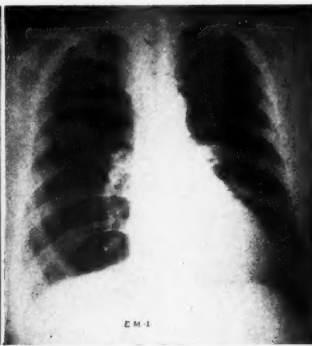


Fig. 2. Case 1. Chest before treatment.



Fig. 3. Case 1. Two months after the first treatment cycle, at beginning of second.

except for brief comment, and confine my detailed description to the four that seem most clear-cut. Two of these four had very large doses; one, having extensive recurrence after simple mastectomy, received a total of 9,850 r (measured in air) over the thorax through four portals, and another, classed as primary inoperable, a total of 13,450 r also through four portals. A third received only 7,800 total r through five portals, but she was a very thin woman, with narrow sagittal chest diameter. I realize that statements of "total r" have no place as accurate description of treatment, but they are used here to indicate proportions only, their distribution being given below. The fourth of my cases received much less treatment into the lung than the others, but as she showed changes similar to those most heavily treated, I present her for the sake of a certain correlation which she suggests. My criteria for considering the pulmonary and pleural changes non-malignant are:

1. The process developing within a certain time relation to treatment, the chest having been clear at the commencement of treatment, and such process remaining stationary or regressing over periods of six months to one year.

2. An autopsy obtained in one of the cases that died subsequently of lobar pneumonia on the opposite side.

However, my primary interest is not so much in pathologic, clinical, or roentgen proofs of the condition itself, all of which have been adduced before, as in offering quantitative information, even though in but four cases, of carefully measured doses delivered *into* the lung, producing under described conditions certain definite effects. My depth dose measurements have been obtained with the aid of Mrs. Edith Quimby, of Memorial Hospital. The figures are based, not on water phantom or special phantom measurements (6), but on the work of Mrs. Quimby and Dr. Copeland (9) on radiation of the lungs of the cadaver, as presented at the First American Congress of Radiology in Chicago in September, 1933.

TECHNIC

K.V.—200 (peak);
ma.—30;
Target-skin distance—50 cm.;
Filter—0.5 Cu and 2.75 Al;
Intensity—62.5 r per minute;
Unit of dosage—1 threshold erythema dose (T.E.D.) = 500 r measured in air.

POINTS CHOSEN FOR ESTIMATION OF DEPTH DOSE (FIG. 1)

Plane AB passes horizontally through the articulation of the first rib anterior;

plane *CD* through the third rib anterior; plane *EF* through the fifth rib anterior.

X, *Y*, *Z* represent points halfway through the chest from front to back on planes *AB*, *CD*, *EF*, respectively. *X'* represents a point one-third the distance from the front on plane *AB*. This point was added because most of the radiation for breast malignancy converges onto the lung from the front. An unlimited number of points could, of course, have been chosen, but for practical purposes, these seemed representative.

PRESENTATION OF CASES

Case 1. Woman of 63, with recurrent carcinoma of left breast with axillary metastases. Simple mastectomy in another hospital in July, 1930. Admitted to Strang Clinic in July, 1933, with diseased tissue all along the scar of previous mastectomy and filling the axilla. Left supraclavicular region showed suspicious fullness; no discrete nodes. Received roentgen treatment only. She was treated through four portals, as follows:

Course 1. Daily treatments of 200 r to each of two portals.

Duration of treatment—24 days.

Amount of treatment:

2,250 r to anterior chest
1,900 r to supraclavicular portal
1,900 r to axilla posterior
1,300 r to axilla direct.

Depth doses at designated points (see Fig. 1):

at *X*—5 T.E.D.
at *X'*—6.5 T.E.D.
at *Y*—3.5 T.E.D.
at *Z*—2.1 T.E.D.

Course 2. Two months later. Two and one-half T.E.D. given on each of two fields directly over regressing metastases, averaging 1 T.E.D. at each of points *X*, *Y*, *Z*.

Following this the masses completely disappeared, and the patient has remained clinically free of carcinoma for one year.

Figure 2 shows the chest before treatment. The lungs are clear; no metastases are seen. Note sclerotic plaque in aortic arch. Figure 3 shows the condition two months after the first cycle, at the beginning of the second. There are seen increased peribronchial markings in the treated area, faint patchy infiltration of the parenchyma adjacent to the hilum, and a diffuse haziness in the axilla suggestive of thickened pleura. During this two-month period the patient had been in good health, with no cough, chest pains, dyspnea, or other symptoms. Figure 4 shows the condition three months after the first cycle, one month after the second. There is increase of all the findings noted in the previous film. Two weeks before this film was made, the patient was ill for one week with chills, fever, cough, and pleuritic pains. Physical signs at the time the film was made: dullness, bronchovesicular breathing, moist crepitant râles from clavicle to fourth rib anterior, from fourth to seventh vertebral spine posterior. Symptoms: productive mucoid sputum, morning cough. Otherwise the patient feels well. Films have been taken monthly to the present time. Figure 5 shows the condition eight months after the first cycle, six months after the second, with about 50 per cent clearing as compared with Figure 4. There is still slight cough and productive sputum in the morning, with dullness and harsh breathing from the clavicle to the fourth rib anteriorly. The patient looks well, feels well, and has gained weight.

The sequence of these changes should be noted. No symptoms were experienced by the patient and only slight roentgen damage was seen following the first cycle, which, as far as I can estimate from data given, probably represented heavier depth radiation, though by different technic, than any previously reported. The early commentators, Groover, and Case, discussing Tyler and Blackman's paper (4) and Groover, Christie, and Merritt (1) mention cough, and even actual pneumonia, occurring ten to fourteen days after the end of the treatment, frequently at the

height of the skin changes, with roentgen changes manifested shortly thereafter. In this case the patient showed erythema

but chiefly by the fact that the patient was slight and thin, her sagittal chest diameter small.

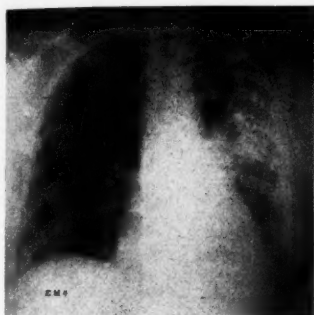


Fig. 4. Case 1. Three months after first cycle, one month after second.



Fig. 5. Case 1. Eight months after first cycle, six months after second.



Fig. 6. Case 2. Chest before treatment.

before the end of the first cycle, followed by complete superficial desquamation during the next two weeks, with restoration of normal skin in about thirty-five days, but throughout this and the ensuing interval before the second cycle, she remained symptom-free. The second cycle, much smaller, with no skin reaction whatever, seems to have set off a fuse which exploded into an acute lower respiratory episode, evidently a bronchopneumonia. Desjardins has stated that reactions are unlikely to follow the first series, coming usually not before the third, while Groover, Christie, Merritt, and Coe find reactions in their group chiefly after the first series. They also state that they now (1927) find that symptoms and signs come on later than they at first reported, only attracting attention two to three months after treatment.

Case 2. This case is not a carcinoma of the breast, but is utilized because of the patient's reaction to thoracic radiation. A young woman, 28 years of age, was admitted in April, 1933, with melanoma of the right scapular region with metastasis to the right axilla. The treatment was on a palliative basis. The relatively high depth doses obtained are to be explained partly by the five portals used (for cross-firing),

Radiation Received.—Daily treatments: five portals; one portal treated per day; 300 to 500 r per portal.

Total: 1,300 r on each of two portals

1,400 r on each of three portals

Total r employed on hemithorax: 6,800 r.

Depth doses at designated points (see Fig. 1):

at X—4.2 T.E.D.

at X'—4.5 T.E.D.

at Y—4.5 T.E.D.

at Z—2.9 T.E.D.

Figure 6 shows the chest before treatment: lungs clear. A film made six weeks after treatment, not offered here because the change is too slight for certain reproduction, showed a barely perceptible haze over the whole right lung-field. There were no pleuritic pains or other symptoms. Three months after treatment (Fig. 7) there is definite homogeneous clouding of the right lung-field, with only slight increase of the right hilum shadow and larger peribronchial markings. The process was interpreted as primarily a pleural reaction. The patient was still symptomless. A film made five months after treatment showed the right lung to be practically clear. A few weeks later, during a spell of cold and stormy winter

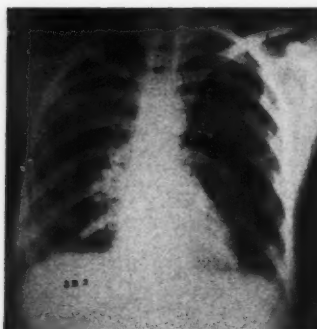


Fig. 7. Case 2. Three months after treatment.

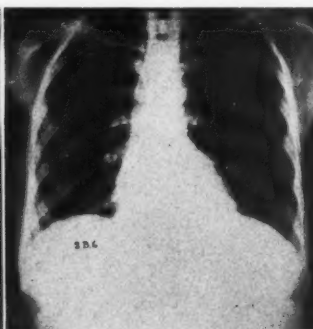


Fig. 8. Case 2. Seven months after treatment.

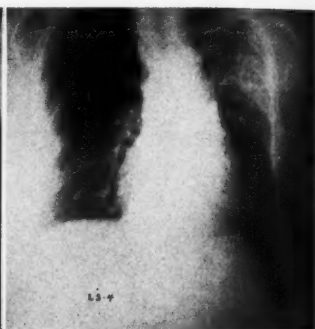


Fig. 9. Case 3. Six months after the first cycle, three months after second.

weather, the patient contracted a moderate head cold, and with it, for the first time, suffered severe pleuritic pains in the right chest. A film made during the attack showed the right lung-field again hazy, though less so than at the three-month period illustrated in Figure 7. In Figure 8 the lungs are again entirely clear, although the patient now has far advanced melanotic metastases elsewhere.

Several writers have touched on the lowered resistance to injuries of irradiated lung. Wintz (10), in particular, speaks of the bad prognosis in the event of intercurrent disease. This aspect of the case might be considered illustrative of the effect of a mild respiratory infection on vulnerable lung and pleura, with, however, a good outcome as far as the local process was concerned.

Case 3. An unmarried woman, aged 66 years, with general arteriosclerosis, who had had at least one stroke, was referred for post-operative prophylactic radiation of the left chest following radical mastectomy for fibrocarcinoma with extensive axillary metastases.

She was given the conventional treatment in use in our laboratory for a number of years, of 750 to 800 r at a single dose, using five portals on the first cycle and three on a second, two and a half months later. She received at the first cycle 2.25 T.E.D. at the point which I have designated X (see Fig. 1). At the second cycle,

1.55 T.E.D. at point X, other areas in proportion. I include only one film of her series.

Figure 9 shows the condition six months after the first cycle, three months after the second. Films at two-month intervals have shown moderate progressive clearing to the present time. The patient has felt well at all times: no cough: no other symptoms: the only sign, harsh breathing over the left upper lobe. Note calcification in the aorta.

Case 4. A woman, aged 68 years, with primary inoperable carcinoma of the left breast with axillary and supraclavicular metastases, the nature of whose tumor was confirmed by aspiration biopsy. She has been treated by roentgen irradiation alone, the details of which are as follows:

Course 1. Four portals; 200 r daily to each of two portals.

Total per portal:

2,660 r to supraclavicular portal
2,660 r to anterior breast
2,470 r to axilla direct
2,660 r to axilla posterior.

Course 2. Three months later; fractional treatment through two portals directly over residual breast and axillary masses.

Total: 1,500 r per portal

Depth doses at designated points (see Fig. 1):



Fig. 10. Case 4. At conclusion of the first treatment course.



Fig. 11. Case 4. Three months after the first cycle and at the conclusion of the second.

Course 1. X —7.9 T.E.D.
 X' —8.5 T.E.D.
 Y —6 T.E.D.
 Z —4.4 T.E.D.

Course 2. Average 1 to 1.5 T.E.D. at points X , X' , Y , Z :

Total r: 10,450 at first cycle (4 portals)
 3,000 at second cycle (2 portals)
 13,450 r in three months' period.

A film made at the conclusion of the first cycle (Fig. 10) shows both lungs clear. The patient stood the treatment well (Course 1), complaining only of moderate general fatigue toward the end. Her red and white blood count was not markedly depressed. Erythema began before the end of the treatment, superficial desquamation of the treated areas was complete after several weeks, and healing was accomplished in about forty days. The immediate post-treatment course was about the same as in Case 1, although more treatment was given. The reason for less treatment and proportionately more marked skin reaction in Case 1 was the fact that the treatment was given during a spell of intense summer heat,

whereas Case 4 was treated in more moderate weather.

Following the administration of over 10,000 r to the thorax, the patient experienced no chest pain, cough, fever, or other symptoms as far as could be learned. A film was made six weeks after the first cycle and showed slight increase of the peribronchial markings in the left lung and a little diffuse haziness in the lower axillary zone. About ten weeks after the first cycle the patient began to have moderate cough and productive morning sputum, and examination of the chest showed dullness, decreased breath sounds, and a few moist râles over the upper two-thirds of the left lung-field. As we were uncertain as to whether or not the findings in the chest were due to metastasis, and as the tumor masses, though rapidly regressing, still contained the possibility of active disease, it was decided to treat again, through two smaller portals, the residual masses. Figure 11 shows the chest three months after the first cycle and at the conclusion of the second.

Ten days later the patient contracted pneumonia following exposure, and died



Fig. 12. Case 4. Vertical cross-section of the left lung. Note consolidated pneumonic area sharply demarcated at base; typical radiation changes above.



Fig. 13. Case 4. Intense thickening of alveolar walls, with exfoliation of lining cells into the lumen; perivascular and peribronchial thickening. No evidence of carcinoma.

shortly afterward. A portable supine film taken two days before her death showed consolidation of the lower half of the right lung, infiltration of the left base, plus the findings previously shown in the upper left lung-field. The question of whether or not her death was due to infection arising first in the vulnerable radiated area and spreading elsewhere cannot be positively decided. The history of severe exposure was authentic, however, and postmortem findings showed practically no pneumonia in the radiated areas and frank consolidation elsewhere.

Figure 12 shows the gross specimen of the left lung in vertical cross-section.

Postmortem examination showed the breast tumor, measuring 1.5 cm. in diameter. No nodes were palpable in the axilla or supraclavicular area. Microscopic examination disclosed an extremely

cellular duct cell carcinoma. There were obvious regressive changes in the tumor, each island of cancer cells being completely circumscribed by a wall of fibrous tissue.

Both lungs were bound to the chest wall and diaphragm by soft, easily broken adhesions. The left apex was found to be densely adherent by old fibrous bands. The left lung, after removal, was seen to be covered for the most part with a sticky, yellowish-green, fibrinopurulent exudate. Cross-section of this lung revealed a firm, consolidated surface. The pleura was definitely thickened and the interlobar pleura was a dense, fibrous band. The entire upper lobe and upper half of the lower lobe were involved in a peculiar consolidation consisting of dense, patchy, dull white areas, many of which seemed to be in close relation to the smaller bronchi. There was definite peribronchial fibrosis throughout.

With a distinct line of demarcation, the lower portion of the left lower lobe was completely consolidated, having a dark, reddish-gray surface and appearing to be lobar pneumonia in the stage of gray hepatization. The right lung showed more extensive pneumonic process, with complete consolidation of both upper and lower lobes. There was entire absence of the peculiar carnification found in the left lung. There was no evidence of metastases in either lung.

A photomicrograph (Fig. 13) which was selected as typical of all the sections made of the left lung, except the base, shows intense thickening of the alveolar walls, with some exfoliation of the lining cells into the lumen. Perivascular and peribronchial thickening are evident in all sections. There was no evidence of cancer infiltration in any of the lung tissue.

DISCUSSION

Taking Cases 1 and 4, which received the most radiation, it would appear that conditions of extensive recurrence and of primary inoperable malignancy were greatly benefited by the heavy dosage employed. It seems highly probable that the price paid in lung damage will be exacted in a large proportion of any further cases so treated. Justification for this risk to the patient, both in primary morbidity or mortality, and in the hazard of intercurrent diseases on vulnerable radiated lung, must, I feel, be decided for each case on its merits. Case 1, obviously hopeless at the outset, has had a year of excellent health, with freedom from demonstrable disease, and no one knows what further expectation of life. Case 4, equally hopeless, showed marked improvement of her primary condition, with axillary and supraclavicular metastases completely dispersed, her breast tumor reduced from $6 \times 8 \times 3$ cm. to 1.5 cm. in diameter, and the small islands of viable cells walled off by fibrous tissue. The existence of viable cancer cells at all, after the heavy radiation received, constitutes the most discouraging

fact of radiation therapy. Critics might be of the opinion that, as long as I could not hope to cure her anyway, I might better have been satisfied with the amount of walling off by fibrous tissue which the first cycle would produce. But there was still a small axillary node remaining before the beginning of the second cycle, and none found when she died. It is very difficult to feel certain whether her right lung and left base pneumonia had anything to do with the traumatized left upper lobe.

It is interesting here to recall that Evans and Leucutia propound the following limits in respect to lung damage: "If a single dose exceeding 100 per cent S.U.D. is delivered to lungs, infiltration may occur. . . . If the dose is lower than 140 per cent S.U.D., the infiltration usually clears up; if it exceeds 140 per cent, fibrosis may develop."

Desjardins (3) states that he has observed some degree of pleuropulmonitis in 2.5 per cent of several hundred cases in which the thorax received from 800 to 1,000 r (measured in air), but has never seen a reaction after 600 r.

In such of my cases as received adequate film examination and clinical follow-ups, about twenty cases from the Strang Clinic and about forty more from the Woman's Hospital, in New York, I have found no other, receiving as little radiation as Case 3, that showed similar roentgen changes, or sufficient clinical signs or symptoms to attract notice.

Other apparent inconsistencies are brought to light in the two following cases, not included in my detailed description.

Case 5. A woman of 54, unusually vigorous and young looking for her age, having mammary carcinoma, was given about the same amount of treatment, in a single cycle, as Case 1. She showed moderate increase peribronchial markings at the right base only, faintly perceptible in film two months after treatment, reaching a maximum at four months, and completely disappearing by the eighth month.

Case 6. A patient 47 years old received moderate roentgen treatment for mam-

mary carcinoma, preceded by heavy radium needling. Two years later she showed dense board-like fibrosis of her pectoral muscle, with the lung beneath entirely clear.

One correlation suggests itself from my material—that of age. While I agree with Desjardins, Groover, Christie, Merritt, and Coe, and others that the effect is a quantitative one, I think the possible influence of age and arteriosclerosis should be scrutinized here and in all subsequent reported cases. Case 1 was 63 years old, Case 3 was 66, Case 4 was 68. Two other of my cases, (7 and 8), receiving heavy thoracic radiation for inoperable malignancies with resulting pleuropulmonitis, not described here because they were complicated by metastasis, were 67 and 78, respectively. All five had advanced arteriosclerosis. Case 2, 28 years old, had a pleuritis of about two months' duration with complete resolution. Case 5, aged 54, showed slight changes, chiefly peribronchial thickening, of six months' duration, or from the second to the eighth month after treatment, with complete restoration. Case 6, with enough radiation to produce excessive soft tissue changes, showed no lung changes whatever. All of these cases were under 60 years of age, and were free of demonstrable arteriosclerosis. Reports in the literature do not consistently note ages of patients, though Davis gives the ages of two out of three of his patients as 44 each. I have not, of course, enough cases, either old or young, that have received intensive protracted fractional treatment to warrant making a definite statement, because such

treatment is necessarily reserved for a selected group of recurrent or inoperable cases, but the point seems interesting and worthy of further observation.

SUMMARY

1. A group of four cases showing varying degrees of pleuropulmonitis from thoracic radiation is described, together with accurate depth dose estimations.
2. Four other cases bearing on the subject are discussed briefly.
3. The possible influence of age and arteriosclerosis on the abnormal lung and pleural changes is suggested.

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SOME OF THE DIFFICULTIES IN THE INTERPRETATION OF CHOLECYSTOGRAMS¹

By CASSIE B. ROSE, M.D., *Presbyterian Hospital, Chicago*

THERE have been many discussions of the efficiency and value of cholecystography, with records of the percentage of errors in the x-ray diagnosis of gall-bladder disease when checked by the operative findings. These articles have led us to a study of 520 cases operated upon, out of more than 5,000 cholecystograms done since June, 1925. All of these cases are from the x-ray departments of Rush Medical College and the Presbyterian Hospital of Chicago, both of which have the same personnel.

The careful checking of the x-ray and operative findings, with re-reading of films and looking for pitfalls in their interpretation, showed us that many errors can be avoided. We found that the most common causes of error, in their order of importance, were due to the following:

1. Gas in the bowel.
2. Fecal or other opaque material in bowel.
3. Technically poor films.
4. Failure to recognize certain film shadows such as:
 - (a) Kidney over liver simulating gall bladder;
 - (b) Loop of bowel mistaken for gall bladder;
 - (c) Gall bladder hidden by bone shadows.
5. Errors in judgment such as the following:
 - (a) Slight variations from normal;
 - (b) Borderline cases not checking with operation.
6. Normals—found to be pathologic at operation.

The lessons we learned from this study are herewith presented. Our cholecystographic procedure is as follows: The dye is given either orally or intravenously ac-

cording to the desire and judgment of the attending physician who also administers it. If given orally, the patient drinks the dye, dissolved in grape juice, at the close of the evening meal. If given intravenously, the dye is injected at 9:00 P.M. Food is then withheld, although water is permitted, and the patient is taken to the roentgen department at nine the next morning. Routinely, films are taken at nine and twelve o'clock, to show, respectively, the filling and concentration of the dye in the gall bladder. A meal of high fat content is then given and another film taken at two o'clock to show the emptying and contraction of the gall bladder.

Variations from the cholecystographic routine are made as follows:

If the dye was given orally, and the gall bladder fills faintly, or not at all, by twelve o'clock, the high fat meal is postponed until after the two o'clock film, and a subsequent film taken at four o'clock to show the possible gall bladder emptying. With the intravenous dye, failure of the gall bladder to fill by twelve o'clock, does not delay the routine procedure.

With both the oral and intravenous dye, failure to empty satisfactorily on the two o'clock film, necessitates another film at four o'clock, to determine the delay in emptying.

If gas or fecal material in the bowel interferes with the visualization of the gall bladder, one or two enemas usually help to clear the gall-bladder field, or at least shift the bowel content and change its position or configuration with reference to the gall bladder, thus differentiating it from a gallstone. Drinking water will usually move the gas in the upper small bowel.

It is very important that the films be of good technical quality. Wet films are examined in order to make any needed change in the routine. After the ex-

¹ Read before the Fourth International Congress of Radiology, July 24-31, 1934, at Zürich and St. Moritz, Switzerland.

amination is completed and the films are dry, the final report is made. As far as results are concerned in both the oral and intravenous methods, I refer to my paper in which I reviewed 1,616 hospital case records, checking as far as possible the clinical and operative findings as compared with the x-ray report of the cholecystogram. There was a surprisingly close agreement between the two methods. As a result of this study, and in view of our subsequent experience, we feel that it is perfectly fair first to give the dye orally, since this is the more simple procedure. Then, if not entirely satisfactory, the examination may be rechecked by the intravenous method. In our experience this is seldom necessary.

We have accepted the customary classification in the diagnosis of cholecystograms and divide the x-ray findings into three groups, as follows:

Group 1. Non-functioning, with or without stones.

Group 2. Poorly functioning, with or without stones.

Group 3. Normally functioning, with or without stones.

The first five of these diagnoses are indicative of a pathologic gall bladder, and the last is an x-ray normal. In the first group of cases the x-ray report of no filling, either with or without stones, is almost certain evidence of a pathologic gall bladder. In a total of 248 cases so reported, the operation revealed stones in the gall bladder or ducts in 200, and a chronic cholecystitis without stones in 33.

Errors in the report of a non-functioning gall bladder occurred in 15 cases, as follows:

In ten patients, whose x-ray films showed no evidence of gall-bladder function, the pathology found at operation was located outside the gall bladder. In eight patients there was a carcinoma of the head of the pancreas, in one a chronic pancreatitis, and in one a tuberculous peritonitis with adhesions to the duct.

Three cases that showed a chronic cholecystitis at operation, were considered

normal on review, once because of gas and an over-penetrated film, and twice because the gall bladder was hidden by bone shadows. In one large patient whose gall bladder had been previously removed, a loop of bowel was mistaken for a faintly functioning gall bladder. One case that was normal at operation was called non-functioning by x-ray, probably because the capsules for the dye, used in our early work, did not dissolve well enough.

Five cases, originally reported as belonging in Groups 2 and 3, would, with our increased knowledge, have been put into this first group of non-functioning gall bladders. At operation, all five showed a chronic cholecystitis with stones.

Our errors were due to the fact that the overlapping shadows of the liver and kidney had been mistaken for a gall bladder. On review it was evident that these shadows had overlapped a little more or less on the various films, due to a shift in position of the patient, and thus had simulated a functioning gall bladder. This error can be avoided only by constantly bearing in mind that the lower end of the kidney-liver shadow is pointed instead of rounded as is the gall-bladder shadow. In this total group of 253 cases, the original x-ray report was erroneous in 7.9 per cent, and after the correction of avoidable errors, was erroneous in 3.9 per cent.

The second group of cases, the x-ray report of which is a poorly functioning gall bladder with or without stones, comprises those in which there is some evidence of function, although less than normal. These are the cases which fill or empty slowly, do not concentrate the dye, are unusually large or small, have some definite deformity of contour, or perhaps are only slightly less dense than normal. All of the 145 cases reported as belonging in this group showed pathology of the gall bladder at operation; stones in the gall bladder or ducts in 127, and chronic cholecystitis in 18. In 15 cases, stones were found which were not reported prior to operation, and in two cases stones which were diagnosed by the x-ray were not found at operation.

Gas in the bowel was responsible for these errors. We feel that it is a serious error to report stones which are not actually present, while the reverse error is permissible.

Of interest in this group were 25 patients whose gall bladders filled and concentrated fairly well, and yet did not empty, or, if so, very slowly. A definite chronic cholecystitis was found in 24; 12 with stones. One patient, with no evidence of a primary emptying in spite of sufficient amount of the fat meal, and with considerable dye remaining in the gall bladder until the next day, showed at operation only a very slight cholecystitis with no stones.

It is important to remember that, before the diagnosis of a pathologic delay in emptying can be made, it must be established that the patient took and retained a sufficient amount of the high fat meal, was not unduly nauseated, and that a primary emptying of the gall bladder with a reabsorption of the dye did not occur. In this group of 145 cases the x-ray diagnosis was erroneous in 1.4 per cent.

In the third group of cases, the x-ray report of a normally functioning gall bladder with or without stones has the highest percentage of error when checked by operation. This report was made in 122 cases.

In the 32 cases diagnosed as normally functioning with stones, the operation revealed stones in 27. It seems quite certain that the five mistakes (15.6 per cent) were caused by gas in the bowel, in all of which the x-ray report stated that the stones were more or less questionable. From this experience it would seem better not to diagnose stones in a normally functioning gall bladder unless reasonably obvious.

The largest number of errors in Group 3 was made in 90 cases diagnosed as a normally functioning gall bladder without stones. In these cases the operation was done for suspected gall-bladder trouble on the basis of the clinical evidence and in spite of the normal x-ray reports. Of the 90 cases reported as normal by x-ray, the

operation revealed a normal gall bladder in 29, and a chronic cholecystitis in 61, 11 with stones.

On re-reading the films after operation, and with our increased knowledge, sufficient changes were noted to place 18 of these cases in Group 2. In that way our percentage of error in Group 3 would be reduced from 54 per cent to 39 per cent and our error in Group 2 changed from 1.4 per cent to 1.2 per cent. Furthermore it is well known that even a moderately severe cholecystitis need not interfere with normal function of the gall bladder, and also, that most surgeons and pathologists report as a chronic cholecystitis all cases in which any change from normal is found.

If the diagnosis of gall-bladder disease is left to the roentgenologist, he wants not only to do a cholecystogram but also a stomach and bowel examination for associated findings which may be elicited, such as compression, deviation of position, or change in function of these organs, or their relationship to a point of tenderness on pressure. In doubtful cases this often helps to swing the diagnosis one way or the other. Sometimes an x-ray study of the urinary tract is also needed.

The reports of 21 American authors who give statistical data concerning their series of cholecystograms, particularly those checked by operation, record a total of 39,280 cases, from which number 5,983 were operated upon. An average of the figures given in these reports indicates that the x-ray diagnosis of a pathologic gall bladder was confirmed at operation in 93.3 per cent, while the x-ray diagnosis of a normal gall bladder was confirmed in only 76.3 per cent.

In the series of 520 cases operated upon, herewith reported, the original x-ray report of a pathologic gall bladder was confirmed in 93.7 per cent, and after restudy and elimination of avoidable errors, in 97.5 per cent. The original x-ray report of a normal gall bladder was confirmed in 32.3 per cent, and after restudy and elimination of avoidable errors, was confirmed

in 52.3 per cent of the cases operated upon for suspected gall-bladder disease.

SUMMARY

1. Technically correct films are important.

(a) Watch wet films and be sure that the gall-bladder region is centered on the film and not hidden under bone shadows.

(b) If the gall bladder is not visible on the first film, turn the patient and take another film.

(c) If the patient vomited the dye, take one trial film and if no gall-bladder shadow is present, repeat the whole procedure.

2. Our greatest source of error was due to gas or fecal material in the bowel.

(a) The giving of enemas or the drinking of water by the patient, helped most to change the size or position of these shadows, and thus aided in film interpretation.

(b) Shadows which simulate gall bladder must be evaluated.

3. Positive findings, either of function or stones, are seldom missed in the x-ray examination.

(a) Of interest is a group of non-functioning gall bladders associated with carcinoma of the head of the pancreas.

4. Indefinite findings are more difficult of interpretation, and call for experience and good judgment on the part of the roentgenologist. In some cases the findings may be questionable as to pathology, not only for the roentgenologist, but for the surgeon and pathologist as well.

5. It is just as important for the radiologist to stand on a diagnosis of normal, as to try to bolster the clinician's diagnosis of a pathologic gall bladder on insufficient x-ray evidence.

6. Only by the closest co-operation between the roentgenologist and the clinician or surgeon, can the highest percentage of correct diagnoses be made and the welfare of the patient best be served.

SYMPOSIUM ON RIGHT UPPER ABDOMINAL PAIN¹

Contributed by D. C. BALFOUR, M.D., Surgeon, *Mayo Clinic, Rochester, Minn.*; B. R. KIRKLIN, M.D., Radiologist, *Mayo Clinic, Rochester, Minn.*; CHARLES HUNTER, M.D., Internist, *Winnipeg, Man., Canada*; B. J. BRANDSON, M.D., Surgeon, *Winnipeg, Man., Canada*, and L. J. CARTER, M.D., Radiologist, *Bigelow Clinic, Brandon, Man., Canada*

Reported by L. J. CARTER, M.D.

DR. BALFOUR stated that pain in the right upper quadrant might be due to lesions in various locations, viz., in the right upper quadrant, elsewhere in the abdomen, in the chest, and to general disease. The most frequent conditions in the right upper quadrant causing pain are lesions in the gall bladder and the duodenum. The more severe the symptoms attributable to these conditions, the greater relief is obtained from surgery. On the other hand, the less severe the symptoms, the less likely is relief to be obtained from surgery. Among the diseases occurring elsewhere in the abdomen the ones most likely to produce pain in the right upper quadrant are those associated with the appendix. The diseases within the chest with which pain in the right upper quadrant is most frequently associated are coronary thrombosis, pneumonia, and pleurisy, especially of the diaphragmatic type. Among general diseases most frequently associated with pain in the right upper quadrant are tabes and herpes zoster.

Discussing the treatment of duodenal ulcer, Dr. Balfour showed a series of lantern slides illustrating the various operations for duodenal ulcer.

Dr. Kirklin showed a very fine series of lantern slides, illustrating duodenal and gall-bladder diseases, these being the chief conditions in the right upper quadrant which are demonstrable radiologically. He stated that the radiologist should recognize lesions of the duodenum in 100 per cent of the cases, although he might not be able to identify the lesion in all the

cases. Duodenal ulcer is recognizable radiologically in 95 per cent of the cases, the fluoroscope being of prime importance in the diagnosis. In acute perforations of the gastro-intestinal tract a diagnostic sign is the presence of gas above the liver and underneath the diaphragm. Acute duodenitis gives characteristic findings, namely, a reticular network of barium in the duodenum, irritability of the first and second parts of the duodenum, and absence of the characteristic crater of an ulcer. A number of characteristic slides of diverticulum of the duodenum were shown. Hypertrophy of the pyloric muscle was shown in a number of slides. The characteristic appearance was an elongated, slightly irregular area of barium connecting the pyloric end of the stomach and the duodenal cap. It is narrow and definitely distinguishable from ulcer and carcinoma.

A very complete analysis was given by Dr. Kirklin of his work in cholecystography, in which he uses the oral method. Lantern slides showed the following findings: normal concentration of the dye, irregularities in size of the gall bladder, deficiency in concentration of the dye, gallstones accentuated by the dye, and papilloma and adenoma. In Dr. Kirklin's hands this method is correct in 97.1 per cent in showing poorly functioning gall bladder, is correct in 96.8 per cent in showing non-functioning gall bladder, and is correct in 89.5 per cent in demonstrating normal gall bladder. The diagnosis of gallstones has been greatly improved by the dye method. In the radiographic work the greatest care must be taken to have the technic perfect. Examples were

¹ The above theme was the subject of a symposium given at the Annual Meeting of the Manitoba Medical Association, in Winnipeg, Sept. 10, 1934.

shown of gallstones missed by poor focussing or by movement of the patient, and these same stones shown when the faults of technic were corrected. Particularly striking was Dr. Kirklin's demonstration of papilloma of the gall bladder, and its differentiation from gallstones and adenoma.

Dr. Hunter emphasized lesions of the abdominal wall as causes of pain. The injection of novocain, 0.5 per cent, relieves the pain. He showed the changed point of view of the surgeon in recognizing that peptic ulcer is largely a medical disease, and not a surgical one primarily, and that surgery should be reserved for such complications as obstruction, perforation, and recurring hemorrhage. Similarly the trend of treatment in gall-bladder disease is away from surgery and toward medical methods. Surgery should be reserved for empyema of the gall bladder, uncontrollable attacks of biliary colic, and the persistence of digestive disturbances in spite of medical treatment. Dr. Hunter emphasized the importance of treating the patient, as well as the disease, in peptic ulcer and gall-bladder disease.

Dr. Brandson stated that we should approach the study of pain in the right upper quadrant through our knowledge of anatomy, particularly of nerve distribution. For instance, the reason for the reference of kidney pain to the external genitals is the fact of their common origin in the same fetal tissue. We also should remember the segmental nerve supply. He called attention to the classic statement of Hilton that the nerve supply of the skin and the underlying organs is from the same nerve segment. One should also remember the position of the sympathetic nerve ganglia as explaining pain radiation; as an example, shoulder pain in right upper abdominal inflammations.

Dr. Carter, in expressing appreciation of the visit of Dr. Kirklin, emphasized the original contributions of Dr. Kirklin, namely, in the diagnosis of pyloric hypertrophy, acute duodenitis, and papilloma of the gall bladder.

Dr. Carter reviewed a number of his own cases which had come to operation for the relief of right upper abdominal pain, and showed that 40 per cent were due to chronic cholecystitis, 14 per cent to adhesions and bands, 9 per cent to duodenal ulcer, 4 per cent to carcinoma of the stomach, 1 per cent each to several other more rare conditions, while 15 per cent showed no demonstrable lesion in the right upper quadrant. In this 15 per cent the lesion was found in the lower right quadrant and was associated with ileocecal pathology. Also, in this 15 per cent the gall-bladder tenderness and the duodenal deformity demonstrated in the right upper quadrant were reflex spastic phenomena, the sure precursors of later pathology.

In the matter of duodenal bands and adhesions, occurring in 14 per cent of the cases, the radiologic indications were deformity of the duodenal cap, with regular lines as distinct from the deformity of ulcer, angulation of the second part of the duodenum upward or outward, and dilated second portion of the duodenum. That the careful removal of these constricting bands and adhesions from the duodenum does give relief of symptoms, was shown in 40 cases operated upon, in which relief was obtained from the symptoms in from 50 to 80 per cent.

Dr. Carter instanced his own experience with cholecystography. He had administered the dye, iodeikon, in nearly a thousand cases, using the oral method. In a series of cases that came to operation, the test was found correct in 95 per cent, in which it indicated gall-bladder pathology. As a test of the absence of gall-bladder disease it was of less value—a diseased gall bladder may be capable of functioning normally. The method has its greatest value as a test of gall-bladder function. A gall bladder, however diseased, if it is functioning normally, according to this test, should not be removed, but should be given a chance of recovery under medical treatment.

Among the methods of examination

for the detection of the cause of right upper abdominal pain mentioned by Dr. Carter were: the Graham functional liver test; an adaptation of the iodeikon test; the use of the intravenous method of pyelography, which is preferable to the retrograde method in suspected right hydronephrosis,

and his condemnation of the use of thoro-trast intravenously as a dangerous method. The barium meal should not be given if acute intestinal obstruction is suspected, or if acute perforation of the stomach or small bowel, or partial obstruction of the large bowel exists.

RESULTS OF TREATMENT OF CARCINOMA OF THE PENIS¹

By HARRY H. BOWING, M.D., ROBERT E. FRICKE, M.D., Section on Therapeutic Radiology, and VIRGIL S. COUNSELLER, M.D., Division of Surgery, Mayo Clinic, Rochester, Minnesota

CARCINOMA of the penis is sufficiently rare to be of considerable interest with regard to its manifestations, mode of growth, and treatment. A survey of the literature on the subject in the past decade reveals an abundance of reports describing one or two cases. There are also excellent detailed studies of a larger series of cases contributed by Barringer and Dean (1), Dean (3, 4), Colby and Smith (2), Lewis (6), Pfahler and Widmann (7), Schreiner (8), Schreiner and Kress (9), and Howze (5). Many authorities report an incidence of from 1 to 3 per cent of penile carcinomas among all carcinomas in the male. During 1931, 3,505 patients with carcinoma were seen at The Mayo Clinic; 1,992 of these were men. Of these 1,992 men, six (or 0.301 per cent) had carcinoma of the penis. A total of 204 men in this series had carcinoma of the genito-urinary organs, and the six with penile carcinoma hence form 2.94 per cent of this group. Although this of course represents only the incidence for one year, it is probably a fair sample of the incidence of this disease.

The incidence of the disease is usually higher among those in the sixth decade of life. Of 195 patients with carcinoma of the penis seen at The Mayo Clinic from 1907 to 1932, 63 (or 32.3 per cent) were between fifty and sixty years of age. Of the remaining patients in this series, seven were in the third decade, 19 in the fourth, 43 in the fifth, 35 in the seventh, 23 in the eighth, and five in the ninth.

The etiologic factors in penile carcinoma are rather uniformly described as phimosis, balanitis, leukoplakia, syphilis, and

trauma. Practically no cases of the disease occur among men who were circumcised in infancy. The Jewish race is almost immune. In the series of 195 cases, phimosis was noted in 87, balanitis in seven, and leukoplakia in one. Wassermann tests were not performed in 62 cases; in the remaining 133 cases only two reactions were positive. A history of syphilis was obtained in nine cases and of gonorrhea in 43. Circumcision in adult life may possibly predispose to carcinoma of the penis, and yet it may be performed because of the irritation of an existent unrecognized lesion, the operation uncovering the growth. In our series, 68 patients (or 34.87 per cent) had recently been circumcised. Not one of our patients had been circumcised in infancy.

To facilitate the study of treatment and of results we have divided all of our cases into four groups according to the extent of the primary lesion and the presence or absence of metastasis. A small lesion of less than 2.5 cm. in diameter, without metastasis, we have designated as belonging to Group I. A similar small lesion with metastasis to the inguinal nodes belonged to Group II. Group III included large lesions more than 2.5 cm. in diameter without evident metastasis to lymph nodes, and Group IV included large lesions with metastasis to the inguinal nodes or elsewhere (Table I).

A careful classification of any type of carcinoma is necessary to study its characteristics and the best methods of treatment. Considering gross pathology, carcinoma of the penis occurs in two forms: the papillary (usually on the glans) and the infiltrating (usually in the prepuce). The former is usually regarded as the more common. In our series, 108 of the

¹ Read (in part) before the Radiological Society of North America at the Eighteenth Annual Meeting, at Atlantic City, Nov. 28-Dec. 1, 1932.

penile carcinomas were pathologically reported to be papillary and 87 infiltrating. Microscopically, the carcinoma is almost always a squamous-cell epithelioma; this was true in our series except for two lesions, one of which was a hemangiosarcoma and the other a melano-epithelioma. Sixty-four (or 32.82 per cent) of the carcinomas in the series were not graded according to

Broders' classification. Of the 131 carcinomas that were graded, 18 (or 13.74 per cent) were of Grade 1; 60 (or 45.80 per cent) of Grade 2; 40 (or 30.53 per cent) of Grade 3, and 13 (or 9.92 per cent) were of Grade 4. Thus of the lesions that were graded, those of lower grades slightly predominated; 60 per cent were graded 1 or 2, and 40 per cent were graded 3 or 4 (Table II).

TABLE I.—CLASSIFICATION ACCORDING TO GROUP

Group	Total	Per cent	Died	Living at last report	Living now	Not traced	Subsequent life in years						Surgery here	Radium here	X-ray here
							1 to 5	5 to 10	10 to 15	15 to 20	20 to 25	Not stated			
I	41	21.02	14	13	10	4	13	14	5	3	1	1	36	8	14
II	36	18.46	19	6	9	2	21	5	4	1	2	1	20	6	14
III	32	16.41	17	3	9	1	21	8			2		28	7	9
IV	86	44.10	56	13	6	11	54	11	7	1		2	41	26	24
Total	195	100	106	37	34	18	109	38	16	5	5	4	125	47	61

TABLE II.—CLASSIFICATION ACCORDING TO GRADE OF MALIGNANCY

Grade	Total	Per cent	Group				Died	Living at last report	Living now	Not traced	Subsequent life in years					
			I	II	III	IV					1 to 5	5 to 10	10 to 15	15 to 20	20 to 25	Not stated
1	18	9.23	6	3	3	2	2	3	6	3	6	2	2	2	1	
2	60	30.77	12	5	13	20	27	13	8	1	32	5	6	2	3	1
3	40	20.51	8	8	7	14	18	9	10		23	9	4	1		
4	13	6.67	1	3	1	4	7	1	1		6	2	1			
Not graded	64	32.82	14	17	8	46	52	11	9	14	42	20	3	2	1	3
Total	195	100.00	41	36	32	86	106	37	34	18	109	38	16	5	5	4

TABLE III.—CAUSE OF DEATH (106 PATIENTS)

	Total	Per cent	Grade										Group							
			1		2		3		4		Not graded		I		II		III		IV	
			Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Died of carcinoma	77	72.64	1	1	20	26	15	19	5	6	36	47	6	8	15	19	10	13	46	60
Died from other causes*	15	14.15			5	33	1	6	2	13	7	46	5	33	1	6	5	33	4	27
Cause not stated	14	13.20	1	7	2	14	2	14			9	64	3	21	3	21	2	14	6	43
Total	106	59.89																		

* Four of these fifteen patients died of apoplexy, four of bronchopneumonia, two of "old age," and one each of influenza, influenza and heart trouble, heart trouble, cerebral hemorrhage, and nephritis and dropsy, and diabetic coma.

Penile carcinomas are, as a rule, very slow growing. In 27 of our cases, symptoms had been present for more than five years. Apparently the growth also metastasizes late. The site of metastasis is determined by lymph drainage. The superficial lymph vessels of the penis drain into the inguinal nodes. The deeper tissues are drained by lymph vessels accompanying the dorsal vein into nodes in the pelvis. As penile epitheliomas remain superficial for a long time, metastasis in most cases is to the nodes of the groin. Logically, the mode of treatment and the results vary with the extent of the disease, so we will consider treatment and results for each separate group.

In Group I (small lesions without evident metastasis) are listed 41 cases, in ten of which operation was performed elsewhere; such operation consisted of excision of the growth in seven cases, dorsal-slit operation in five, biopsy in three, and cautery in ten. Five of these patients had had radium treatment elsewhere. In 36 of the cases operation was performed at the Clinic and consisted of biopsy in four cases, circumcision and excision in two, excision of the growth in six, amputation of the penis in eight, partial amputation in five, radical amputation and dissection of the inguinal nodes in one, emasculation in one, amputation and bilateral dissection of the nodes in thirteen, and dissection of the nodes in two. In eight cases radium was applied to the penile growth at the Clinic; in four of these, it was applied post-operatively. In six cases it was applied to the inguinal nodes post-operatively. Low voltage roentgen-ray treatment was applied to the penile growth in five cases, and the same treatment was used over the inguinal nodes in thirteen. Ten patients in this group replied to letters sent them six months prior to the writing of this paper; 13 could not be traced at this time, but were living at the time of a previous inquiry, four could not be traced at this time nor at the time of the previous inquiry, and 14 were definitely known to have

died. When last heard from, 13 of the patients in this group had lived from one to five years, 14, from five to ten years, five, from ten to 15 years, three, from 15 to 20 years, and one, from 20 to 25 years.

Group II (small lesions with metastasis) contains 36 cases, in 17 of which surgical procedures were performed elsewhere. Twenty patients underwent operation at the Clinic, which consisted of biopsy in three cases, circumcision and excision in one, excision in three, simple amputation of the penis in seven, amputation with dissection of the nodes in six, partial amputation without dissection of nodes in one, and partial amputation with dissection of the nodes in three. A dorsal-slit operation was performed in one case and removal of inguinal nodes in four cases. Radium treatment was given in six cases; in three of these to the primary lesion and in three to the inguinal nodes. Roentgen-ray treatment was applied in 14 cases. Nine patients in this group replied to letters sent them six months prior to the writing of this paper; six could not be traced at this time but were living at the time of a previous inquiry, two could not be traced at this time nor at the time of the previous inquiry, and 19 were definitely known to have died. When last heard from, 21 of the patients in this group had lived from one to five years, five, from five to ten years, four, from ten to 15 years, one, from 15 to 20 years, and two, from 20 to 25 years.

Group III (large lesions without metastasis) contains 32 cases, in seven of which some form of operation had been performed elsewhere. Surgery was performed at the Clinic in 28 cases and consisted of biopsy in two, circumcision and excision in one, simple excision in four, amputation of the penis in seven, amputation with dissection of the nodes in eleven, partial amputation with dissection of the nodes in one, radical amputation in four, dorsal-slit operation in one, plastic operation in three, and removal of all inguinal nodes in two. Radium treatment was applied in seven cases to the primary lesion

and in five to the inguinal nodes as well; roentgen-ray treatment was given to nine patients (in two of these cases to the primary lesion). Nine patients in this group replied to letters sent them six months prior to the writing of this paper; five could not be traced at this time but were living at the time of a previous inquiry, one could not be traced at this time nor at the time of the previous inquiry, and 17 were definitely known to have died. When last heard from 21 of the patients in this group had lived from one to five years, eight, from five to ten years, and two, from 20 to 25 years.

Group IV (large lesions with metastasis) contains by far the largest number of cases, 86, or 44.10 per cent of the total. In 38 of these cases some form of operation had been performed elsewhere. In 41 cases operation was performed at the Clinic and consisted of biopsy in six, circumcision and excision in one, simple excision in one, simple amputation in 18, amputation with removal of the nodes in eleven, partial amputation in one, partial amputation with removal of the nodes in two, radical amputation in two, emasculation in three, plastic operation in two, and dissection of inguinal nodes in seven. Twenty-six patients had radium treatment; 17 to the primary lesion and 26 to the inguinal nodes. Twenty-four had roentgen-ray treatments, four to the primary lesion, and the remainder to the groins. Six patients in this group replied to letters sent them six months prior to the writing of this paper: 13 could not be traced at this time but were living at the time of a previous inquiry, 11 could not be traced at this time nor at the time of previous inquiry, and 56 were known to have died. When last heard from, 54 had lived from one to five years, eleven, from five to ten years, seven, from ten to 15 years, and one, from 15 to 20 years.

Considering the entire four groups, and leaving out the 18 patients who were not traced, 34 patients (19 per cent) have replied to letters sent them, 37 (21 per cent) could not now be traced but were living at the time of a previous inquiry,

and 106 (60 per cent) were definitely known to have died (Table III). When we consider that this study began in 1907, that these patients are in the cancer age, that their life expectancy is low, and that seven of them had other co-existing malignant conditions (three had carcinoma of the lip, two of the face, one of the bladder, and one of the rectosigmoid), the high death rate is to be expected. Of the 106 patients who were known to have died, 77 died of carcinoma, 15 died of causes unrelated to the carcinoma, and for the remaining 14 the cause of death was not stated.

The results of treatment according to the grade of malignancy comply with our expectations. Considering only the cases in which the patients were traced and the lesions graded, six of the patients with lesions of Grade 1 are known to be living and two are known to have died, eight of those with lesions of Grade 2 are living and 27 are known to have died, ten of those with lesions of Grade 3 are living and eighteen are known to have died, and one with a lesion of Grade 4 is known to be living and seven are known to have died. Of those with ungraded lesions, nine are living and 52 have died.

The preponderance of cases in this report in which some surgical procedure was employed is due in large measure to the fact that this review begins in 1907 and radium did not come into use at the Clinic until about 1915. Of late years, irradiation has been the usual practice, together with whatever surgical intervention is indicated. In what follows, the patients whom we list as now living have all been traced within the past six months, and we have definite information about those patients listed as having died. However, there is a large number of patients who have not been traced up to the present time. Many patients have lived five or ten years since treatment, and were perfectly well at the time when last heard from (Table IV). Considering our entire 195 patients, 62 (or 31.79 per cent) were treated by surgery alone. Eleven of these patients are still living, 34 have died. The next largest

group received both surgical treatment and irradiation with roentgen rays; there were 37 patients in this group, or 18.97 per cent of the total. Eleven of this group are known to be living and eleven are known to be dead. The next largest group, consisting of 15 patients or 7.69 per cent of the total received surgical treatment and irradiation with both radium and roentgen rays: two of these patients are known to be living and ten are known to be dead. Thirteen patients (or 6.66 per cent) received surgical treatment and irradiation with radium; four of these are now living and eight have died. Radium was the only treatment given 12 patients (or 6.15 per cent): one of these is living and nine have died. Radium and roentgen rays

together were used without any surgical treatment in seven cases (or 3.58 per cent): two of these patients are living and four have died. Irradiation with roentgen rays alone was used in two cases (or 1.02 per cent): these two patients have not been traced. No treatment at all was given in 47 cases (or 24.10 per cent): of the patients in this group, three are still living and 30 are known to be dead.

SUMMARY

This study is based on 195 cases of epithelioma of the penis which were encountered at The Mayo Clinic from the beginning of 1907 to January, 1932. A large proportion of the total, 47 patients in all, received no treatment at the Clinic.

TABLE IV.—SUMMARY OF TREATMENT GIVEN

Type of treatment	Total	Per cent	Living at last report	Per cent	Died	Per cent	Not traced	Subsequent life, years						Group			
								1 to 5	5 to 10	10 to 15	15 to 20	20 to 25	Not stated	I	II	III	IV
Surgical only	62	31.79	21	29.57	34	32.07	7	33	6	8	5	2	1	19	10	16	17
Surgical and roentgen ray	37	18.97	26	36.61	11	10.37	0	23	10	4				10	9	6	12
Surgical, radium, and roentgen ray	15	7.69	5	7.04	10	9.43	0	10	3	1				4	3	1	7
Surgical and radium	13	6.66	5	7.04	8	7.54	0	9	3			1		3		5	5
Radium alone	12	6.15	3	4.22	9	8.49	0	12	1					1	1		10
Radium and roentgen ray	7	3.58	3	4.22	4	3.77	0	6	1						2	1	4
Roentgen ray alone	2	1.02	0		0		2										2
None	47	24.10	8	11.26	30	28.30	9	31	3		1		3	4	11	3	29
Total	195		71		106		18	124	27	13	6	3	4	41	36	32	86
	Total traced		Now living														
Surgical only	45	32.14	11	32.35	34	32.07		29	5	5	3	2	1	13	9	12	11
Surgical and roentgen ray	22	15.71	11	32.35	11	10.37		13	5	4				4	5	6	7
Surgical, radium, and roentgen ray	12	8.57	2	5.88	10	9.43		10	1	1				2	3	1	6
Surgical and radium	12	8.57	4	11.76	8	7.54		9	2			1		3		4	5
Radium alone	10	7.14	1	2.94	9	8.49		10							1		9
Radium and roentgen ray	6	4.28	2	5.88	4	3.77		5	1						2	1	3
Roentgen ray alone	0																
None	33	23.57	3	8.82	30	28.30		28	1		1		3	2	8	2	21
Total	140	71.79	34		106			104	15	10	4	3	4	24	28	26	62

Sixty-two patients received surgical treatment alone at the Clinic. The remainder received a combination of surgical treatment and irradiation with roentgen rays, surgical treatment and irradiation with both radium and roentgen rays, surgical treatment and irradiation with radium, irradiation with radium alone, irradiation with radium and roentgen rays, or irradiation with roentgen rays alone. The cases have been divided into groups depending on the extent of the primary lesion and the presence or absence of metastasis. They have also been divided according to the microscopic grade of the lesion. One hundred and six patients have died, 34 are known to be still living, and the remainder have not been traced up to the time of the present writing, although the majority of these were well when last heard from.

The subsequent life in years has been worked out for all patients. We find that five have lived from 20 to 25 years, five have lived from 15 to 20 years, and the remainder for shorter terms since the time of the first treatment.

It is obviously incorrect to contrast the results in those cases in which patients received only surgical treatment, or were treated by irradiation alone, with the results in those cases in which patients received a combination of surgical treatment and irradiation, as the group of cases in which patients received surgical treatment alone is made up of cases seen prior to 1915, when treatment by irradiation was instituted at the Clinic. The results have been good when we consider that the data go back over a period of 25 years and deal with patients of the cancer age whose life expectancy is ordinarily less; many have died of other complications and seven of the group had malignant lesions of other parts of the body. Further, it is interesting to note that these good results have accrued mainly from conservative surgery. Considering the total experience of these patients here and elsewhere, only 45 (or 23.07 per cent) received radical

surgical treatment; 84 (or 43.07 per cent) received conservative surgical treatment, and 50 (or 25.64 per cent) received minor surgical treatment.

CONCLUSIONS

Epithelioma of the penis is a slow-growing neoplasm which is inclined to remain superficial for a long time, to metastasize late, and, when such metastasis does occur, to affect the inguinal nodes. The slow growth and accessibility of the lesion render it amenable to surgical treatment and to irradiation with radium and roentgen rays, either alone, or probably best in combination. The type of surgical procedure obviously depends on the extent of the lesion and the presence or absence of metastasis, and to some extent also on the wish of the patient. In inoperable cases, irradiation alone accomplishes a great deal in the way of palliation. Obviously the earlier the condition can be diagnosed, the better the chance of permanent cure by a combination of surgical treatment and irradiation.

Circumcision in infancy must receive more attention as a means of preventing malignant disease of the penis (10).

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RECOMMENDATIONS OF THE INTERNATIONAL COMMITTEE FOR RADIOLOGICAL UNITS (ZÜRICH, 1934)

SECTION A

1. The International Unit of Quantity of X-radiation shall be called the "roentgen" and shall be designated by the symbol "r."

2. The International Unit of X-radiation shall be the quantity which, when the secondary electrons are fully utilized, and the wall effect of the chamber is avoided, produces in one cubic centimeter of atmospheric air at 0° C., and 76 cm. mercury pressure, such a degree of conductivity that one electrostatic unit of charge is measured at saturation current.

SECTION B

3. Dosage measurement shall be made in roentgens. Dosage rate shall be expressed in roentgens per minute.

4. All dosage measurements shall distinguish between the air dose which does not include scattered radiation, and the effective dose which includes scattered radiation.

5. The specification of dosage shall include a statement of the quality of the radiation. For exact physical measurements, the quality of the radiation may be specified in terms of the complete absorption curves in copper or aluminum. For most practical purposes, the quality may be expressed by the first and the second half value layers of the same materials.

6. The specification of dosage shall also include:

- (a) Dosage rate;
- (b) The total time of irradiation and the intervals between the times of irradiations;
- (c) Material and thickness of filter;
- (d) Target-skin distance;
- (e) The dimensions and number of ports of entry.

7. The practical instrument used to measure x-ray quantity shall be called a dose-meter, and shall be calibrated in roentgens.

8. The calibration of a dose-meter shall be tested periodically by a recognized testing laboratory, over the range of wave lengths for which it will be used.

9. The constancy of the calibration of a dose-meter shall be tested by the ionization produced, under fixed conditions, by a definite quantity of radium element.

10. Dose-meters should be independent of the wave length within the range for which they will be used.

Note.—For details of standard measurements and the calibration of dose-meters, attention is directed to the joint reports issued by the National Standardization Laboratories.

SECTION C

The Committee is of the opinion that the ionization measurement of gamma radiation is promising. The necessity for further investigation is urged to discover if any difficulties of a fundamental character exist in connection with the experimental realization of the roentgen over the widest possible range of wave lengths.

RULES GOVERNING THE SELECTION AND WORK OF THE INTERNATIONAL COMMITTEE FOR RADIOLOGICAL UNITS

1. The International Committee for Radiological Units shall be constituted of two representatives from each country sending delegates to the Congress. When a country has a central X-ray Standardization Laboratory, it may, in addition, send a representative of that laboratory. Of the representatives from a single country, at least one must be a radiologist and one a physicist.

2. There shall be a standing sub-committee of the International Committee for

Radiological Units consisting of six members including the chairman.

3. The sub-committee shall elect its own chairman and secretary from amongst its members.

4. The sub-committee shall report on the progress of dosage measurements and prepare the program to be submitted to the main committee. The report shall be published, and circulated to members of the main committee at least six months before the meeting of a Congress.

Members of the Sub-committee.—I. Solomon, *Chairman*; L. S. Taylor, *Secretary*; H. Behnken; E. A. Owen; E. Pugno-Vanoni; R. Sievert.

Members of the International Committee for Radiological Units Preparing the Above

Report.—P. Scherrer, Switzerland, *Chairman*; H. Koenig, Switzerland, *Vice-chairman*; H. Holthusen, Germany, and E. A. Owen, Great Britain, *Hon. Secretaries*; H. Behnken, Germany; F. Béhounek, Czechoslovakia; A. Bouwers, Holland; E. C. Ernst, U. S. A.; N. S. Finzi, Great Britain; G. Guében, Belgium; L. Haas, Hungary; H. M. Hanson, Denmark; S. A. Heyerdahl, Norway; D. den Hoed, Holland; F. Holweck, France; A. Liechti, Switzerland; M. Ponzio, Italy; E. Pugno-Vanoni, Italy; R. M. Sievert, Sweden; I. Solomon, France; L. S. Taylor, U. S. A.; K. T. Watanabe, Japan.

Approved by the Fourth International Congress of Radiology, St. Moritz, July 31, 1934.

THE MESENTERY¹

A RADIOLOGIC STUDY

By R. POMERANZ, M.D., Newark, N. J.

CONSIDERED anatomically, the mesentery represents two layers of peritoneal lining separated by loose connective tissue in which branches of arteries, veins, and lymphatics extend to

the intestinal tract. Therefore, broadly speaking, we should include the following structures: liggamenta, gastro-hepaticum, hepatoduodenale, gastro-lienale, gastro-colicum, bursa omentalis, mesocolon trans-



Fig. 1. Postero-anterior and lateral views of a rabbit, 150 days after an intraperitoneal injection of 10 c.c. of thorotrast. (A) Outline of the peritoneal lining of the abdominal cavity. (B) Lymphatic sacs in the chest. (C) Lymphatics of the mesentery.

¹ Presented before the Fourth International Congress of Radiology, Zürich, Switzerland, July 24-31, 1934.

versum, and sigmoideum, besides the radix mesenterii, which is the chief object of our

discussion. In a restricted sense, the mesentery is, then, that part of the duplicated peritoneal lining which extends from

artery. The U-loop cannot move freely in a lateral direction, because its apex is fixed to the umbilicus by means of the



Fig. 2. Barium enema showing roentgen signs of active tuberculous infiltration of the cecum and ascending colon.



Fig. 3. The same as Figure 2. Visualization of the cecum in the left lateral position by means of barium and air inflation.

the radix mesenterii to the small intestine. It originates on the left border of the second lumbar vertebra and extends obliquely toward the right iliac fossa, ending just above the right sacro-iliac region. All of these structures show numerous anatomic variations, some of which are of clinical importance. To understand this, it is advisable to review briefly their embryologic development.

Maldevelopments and Variations.—In the fifth week of embryonic life, the digestive tract is represented by a long duct: the fore-gut is fixed in the mid-line of the body by the ventral and dorsal mesenteries (Hubeny). The mid- and hind-guts are suspended from the posterior body wall only by their dorsal mesenteries: the ventral mesenteries have disappeared. The mesentery of the mid-gut is long, and the intestinal tube forms a long U-loop which is supplied by the superior mesenteric

vitelline duct. However, it is able to rotate around its base, where the two limbs of the U are close together. After the fifth week the mid-gut increases in length very rapidly: its mesentery becomes fan-shaped and capacious, except at the base of the loop, where it is reduced to a narrow isthmus through which the superior mesenteric artery passes. At the beginning of the third month the U-shaped loop twists around the isthmus from right to left, thus elevating the distal part of the hind-gut, which becomes attached on the left side, as the splenic flexure of the colon. The rest of the colon proximal to this swings over the front of the abdominal cavity from left to right, becoming attached to the structures of the posterior body wall along a line extending from the left to the right kidney, and thence down to the right iliac fossa. This explains why a part of the small gut (second and third parts of



Fig. 4. G. B., male baby, 3 months old, showing gas compression of sigmoid causing regurgitation of the enema fluid. Diagnosis: Intussusception of ileum into the colon.



Fig. 5. Same as Figure 4.

the duodenum) is situated behind the transverse colon, while the rest (jejunum and ileum) lies freely in the abdomen, below the transverse colon. It is attached with its radix mesenterii posteriorly along the line described above, extending obliquely from the second lumbar vertebra on the left side to the right sacro-iliac region. The free mesentery is covered on both sides by the peritoneal lining; the attached one, on its anterior surface only. Variations in the four major processes involved in this embryonic change (migration, rotation, descent, and fixation) may occur by excess or defect. It is impossible to cite all the current developmental anomalies. We shall discuss below those most important for the surgeon and the clinician.

Physiology.—The function of the mesentery is twofold. It obviously serves as a medium of lymphatic and blood supply to the gut, and it may also be considered as a medium for the fixation of the intestines to the abdominal wall. The latter function is doubtful, in the opinion of Alvarez, who asserts that the intestines are floating freely in the abdominal cavity.

At the present status of our knowledge the direct visualization of the mesentery is impossible. No method has been devised which will enable one to recognize the vascular structures of the mesentery. Even if a suitable opaque medium were available, the injection would have to be made so near the vital organs as to render the procedure dangerous to life. The visualization of the peritoneal lining of the

mesentery has been attempted and accomplished by several investigators. Held, Menville, Pomeranz, and others have injected colloidal thorium into the abdominal cavity of animals, which thorium has been retained by the reticulo-endothelial cells, thus giving a very good radiographic outline of the peritoneal lining of the entire abdominal wall and of the mesentery (Fig. 1). These experiments demonstrate the interrelationship of the lymphatic systems of the abdominal cavity and of the chest: they also demonstrate the practicability of this method in retroperitoneal tumors. The difficulties are, first, that the opaque medium is not eliminated, and secondly, that the thorium is slightly radio-active and, as such, is not suitable for human beings.

I have performed animal experiments, using the now available iodide preparations such as skiodan, hippuran, and others for this purpose. However, after intraperitoneal injection of a few cubic centimeters of these preparations, the absorption was so rapid that for practical purposes no proper visualization could be accomplished. These experiments will be reported in detail at a later date.

The only available method is the indirect study of the mesentery in human beings by means of visualization of the intestines with a barium meal or a combination of barium and air. On radiographic and fluoroscopic study of the intestines, one should observe the following: (1) Distribution of gas in the abdomen; (2) position of the gut in various views; (3) passive mobility on palpation; (4) motility; (5) topical relationship of the gut with the other abdominal organs (kidneys, liver, and spleen), also in the lateral view if necessary; (6) correlation of the roentgen symptoms with the type of individual.

Congenital Anomalies.—A knowledge of intra-abdominal malformations is important both to the surgeon and to the internist. For example, the pre-operative knowledge of a non-rotated cecum situated high under the liver, in a case of an acute appendicitis, may be instrumental in sav-



Fig. 6. Same as Figures 4 and 5.

ing the life of the patient, as it will shorten and simplify the operation. Many authors have described the various forms of malformation and their clinical and radiologic significance. The most important malformation is the mesenterium commune. This is due to failure of the navel loop of the small intestines to rotate: it may be the cause of intussusception or obstruction, or both. The recognition of the varying length of the mesentery by the position and passive mobility of the gut may be helpful in the localization of pain in the abdominal cavity. The roentgen symptoms were recently described by Kadrnka and others.

Acquired Anomalies.—These are caused by fibrous changes of the mesentery and can be due to: (1) Post-operative adhesions; (2) fibroplastic tuberculous lesions (Figs. 2 and 3); (3) neoplastic shrinkage; (4) post-radiation fibrosis.

Inflammatory Changes.—We know that the distribution of the gas in the abdomen

is a very important diagnostic symptom. One should, therefore, try to visualize the abdomen in the upright and prone posi-

The radiographs (Figs. 4, 5, and 6) reveal a small amount of barium filling out the rectum and the sigmoid. The sigmoid

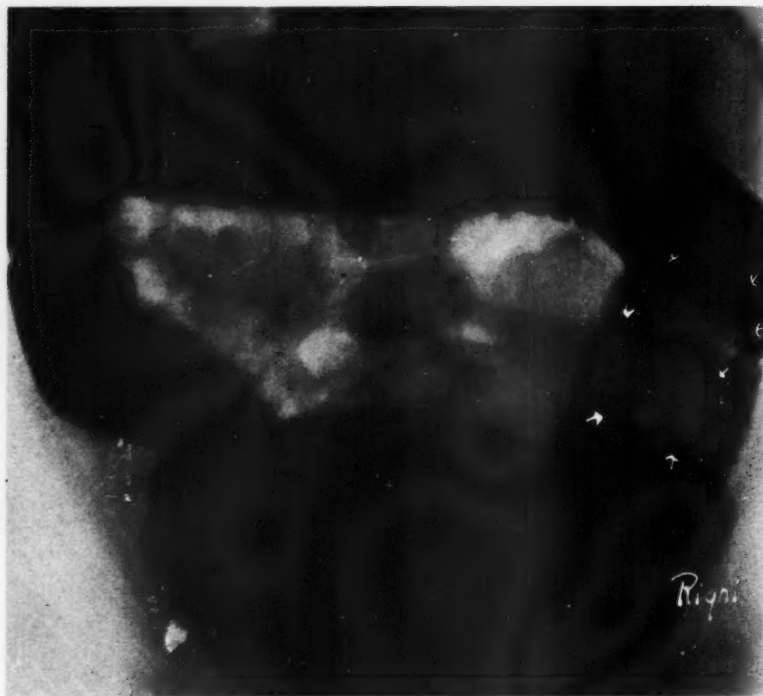


Fig. 7. S. P., female baby, 14 months old. Barium enema showing large sharply defined defects of the cecum and ascending colon caused by intussusception of ileum into the colon. Compare these roentgen symptoms with those of Figures 4, 5, and 6.

tions, and in the postero-anterior and lateral views, as it will often enable one to localize the point of obstruction.

Let me cite at this point two cases of intussusception in children and one case of inflammatory tumor in an adult with their respective operative findings. (Courtesy of Dr. Weinberg, Dr. Danzis, and the X-ray Department of Newark Beth Israel Hospital.)

Case 1. Male baby, G. B., three months old, became ill less than 48 hours prior to the x-ray examination. The abdomen was distended. Barium enema was attempted, and the fluid regurgitated immediately after the injection. The injection was repeated with a small catheter, and even then the fluid was immediately returned.

extended upward toward the mid-line and showed obstruction in its upper end, apparently due to gas compression. The right and left sides of the abdomen showed several overlapping widened loops of the gut filled with gas. The radiologic diagnosis was as follows: Probable intussusception of the ileum into the colon up to the transverse colon, with compression of the sigmoid.

Operative Findings by Dr. Danzis.—Free fluid in the peritoneal cavity. A large sausage-shaped tumor (right side) consisting of the ileum, cecum, and appendix, which were intussuscepted into the ascending and transverse colons, filled up the entire transverse colon to the splenic flexure.



Fig. 8. A. E., male, 60 years old. Barium enema showing poor, feather-like filling of the ascending colon. The palpable mass is outlined at the region of the iliac fossa.



Fig. 9. Same case as Figure 8. Air inflation of the colon.

Case 2. Female baby, S. P., 14 months old, ill for 24 hours prior to the x-ray examination. Barium enema (Fig. 7) showed good filling of the entire colon up to the ascending colon. The cecum and ascending colon showed a sharply defined defect, around which the barium flowed to reach the proximal end of the colon. The x-ray diagnosis was: Intussusception of the ileum into the ascending colon.

Operative Findings by Dr. Danzis.—The ileum, 18 inches from the ileocecal junction, was intussuscepted into itself. The intussuscepted portion was then intussuscepted into the cecum, reaching as far as the hepatic flexure of the colon. At this point there was a small segment of the ileum markedly indurated, forming a constriction ring, and the serosa, at that area, was deeply injected. There was a chain of enlarged glands at the ileocecal junction.

Case 3. Male, A. E., 60 years old, had an attack of appendicitis two weeks prior to the x-ray examination. On palpation one could find a large mass in the right lower quadrant about three inches in diameter, resilient, not freely movable, and not tender to pressure. Barium enema (Fig. 8) revealed multiple diverticula of the entire colon. The barium fluid reached the ascending colon without difficulty: at that point the colon and cecum were narrow, feather-like in appearance, and incompletely filled. Some of the barium passed into the terminal ileum. The cecum showed a high fixation. The inflation of air (Fig. 9) and the subsequent oral meal (Fig. 10) gave the same findings. The terminal ileal loop was better visualized by the oral meal and appeared to be partly compressed and fixed.

Operative Findings by Dr. Dwyer.—The palpable mass on the right side consisted of the terminal ileum loops, the cecum and

ascending colon being matted together by extensive and apparently not very old adhesions. The serosa of the gut and of

x-ray symptoms, therefore, resemble those of inflammatory ileus, recognized by the distribution of gas, horizontal levels, etc.



Fig. 10. Same case as Figures 8 and 9. Oral barium meal shows better filling of the terminal ileal loops, cecum, and ascending colon. The latter shows high fixation and has a feather-like appearance, indicating an inflammatory process.

the mesentery was injected. The appendix was adherent to the cecum, markedly thickened, and somewhat injected. After separating the adhesions, the entire mass dissolved itself into the respective loops described above.

All three patients made uneventful recoveries.

In mesenteric thrombosis the clinical symptoms result from the defective blood supply which causes paralytic ileus. The

Neoplastic Changes.—Primary tumors of the mesentery are rare and are seldom diagnosed pre-operatively by means of the x-ray examination. I had an occasion to examine the following case of mesenteric cyst, reported through the courtesy of Dr. Greenfield and Dr. Nash, and the X-ray and the Pathologic departments of the Newark Beth Israel Hospital.

Case 4. M. B., male, 28 years old, was sent to the hospital for observation,



Fig. 11. M. B., male, 38 years old. Sketch of barium enema reproduced from the original films, showing the displacement of the main parts of the colon, due to the cystic growth of the mesocolon and mesosigmoid. Mesenteric cyst.

after complaining for the last 18 months of becoming stout, gaining weight, and of an enlargement of his abdomen. I examined the patient in the fluoroscopic room. The abdomen was very large, measuring about fourteen inches in diameter, and showed the presence of encapsulated fluid. The barium enema showed no defects of the colon, but did indicate marked displacement of each of its segments in different directions, *i.e.*, the sigmoid was displaced to the left side, the transverse colon, upward, and the ascending colon to the right side. This indicated a mass situated probably in the mesentery (mesocolon and mesosigmoid) showing an expansive growth (Fig. 11). From this examination, I suggested that the tumor was probably due to a mesenteric cyst.

Operative Findings by Dr. Greenfield.—The abdomen was uniformly enlarged. On opening the peritoneum, there was found a large fluctuating mass (Fig. 12)

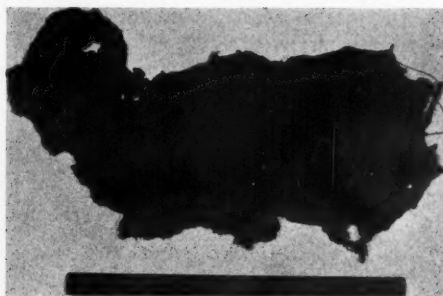


Fig. 12. Photograph of the anatomic specimen of the mesenteric cyst wall.

which filled out the entire abdominal cavity, with the omentum attached to its anterior surface. This mass originated from the mesentery and contained a large amount (1 liter) of serosanguinous fluid, cheesy material, and clotted blood. Another small cyst within the larger one contained a moderate amount of yellowish fluid resembling pus.

Microscopic Diagnosis.—A very vascular fibromyxoma of the mesentery was found, with cystic degeneration and chronic infection (Figs. 12 and 14).

Neoplastic Changes.—Secondary neoplastic changes of the mesentery may be due to primary intestinal growth or to a general peritoneal infiltration (ovarian tumors).

Case 5. Male, T. C., 50 years old, complained of some loss of weight and the presence of a mass in the right lower quadrant. One year prior to the examination an appendectomy had been performed. On palpation, a movable mass, not tender to pressure and about three inches in diameter, could be noted in the right lower quadrant. Barium enema showed an irregular narrowing of the sigmoid—it was pulled over to the right side (Fig. 15). This defect of the sigmoid measured about two and a half inches in length. At the same time one could notice the defect of the cecum. The air inflation after the barium enema showed normal rugæ of the sigmoid, indicating that the tumor was

located at the ileocecal region and grew around the sigmoid.

Operative Findings.—The tumor in-

Radiologic Diagnosis.—Early neoplastic tumor of the sigmoid.

Operative Findings by Dr. Haussling.—A

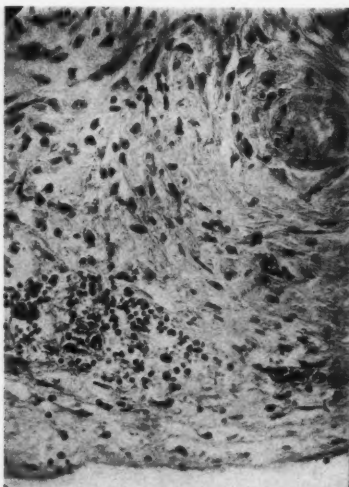


Fig. 13. Photomicrograph of the wall of the cyst, showing many fibroblasts and round-cell infiltrations.



Fig. 14. Photomicrograph of the wall of the cyst, showing areas of myxomatous degeneration.

volved the cecum, terminal ileum loop, and the sigmoid which was adherent to the mass. The mucous membrane of the latter was normal.

Microscopic Diagnosis.—The gelatinous type of carcinoma probably originated from the cecum.

Case 6. Male, C. R., 55 years old, in good general physical condition, gave a history of the passage of bloody stools on one occasion, about two weeks prior to the examination. The x-ray examination with the barium meal revealed no defects, nor did two examinations by means of barium enemas. No mass was palpable in the abdomen. At a third examination of the colon by means of barium and air² (Fig. 16), a small defect measuring about one and a quarter inch in length could be noted in the right lower quadrant at the level of the iliac fossa. Even then, only a small resistance was palpable at that region and no tenderness could be elicited.

² All of these examinations were carried out within a week.

small mass measuring about one and one-half inches in length, was found in the sigmoid which was pulled through a left abdominal incision. Two glands were palpable, one in the mesentery and the other next to the abdominal aorta.

Microscopic Findings.—Adenocarcinoma of the sigmoid.

Comments.—I wish to emphasize the necessity of differentiating the inflammatory from the neoplastic changes in the mesentery. Any inflammatory lesion, whether due to infection, non-obstructive ileus, or intussusception, shows radiographically a feather-like appearance of the nearby gut. In a neoplastic change of the mesentery, no roentgen symptoms can be observed except for the defects of the corresponding gut. This principal difference should be kept in mind when interpreting the films.

Mesenteric Calcifications.—One very often finds calcific deposits in the abdomen in the course of general routine examinations for disease of the genito-urinary

tract. These calcific deposits should be differentiated by the following: (1) Location in the antero-posterior and lateral

grouped together. Urinary calculi are more solid in appearance and are projected in the course of the genito-urinary



Fig. 15. T. C., male, 50 years old. Barium enema shows filling defects of the cecum and sigmoid. Mass outlined. The ragged appearance of the defect, and the subsequent visualization of normal rugae of the mucous membrane of the sigmoid, indicated an infiltration around the wall of the sigmoid. Operative diagnosis: Gelatinous carcinoma of the cecum growing around the sigmoid.

positions; (2) mobility on palpation under the screen; (3) radiographic appearance. The mesenteric calcifications are situated laterally and anteriorly in relation to the spine: as a rule they have a glandular appearance, are irregularly calcified, and consist of multiple calcium deposits

tract. In the lateral view, the pelvic calculi are projected on the body of the second lumbar vertebra. Calcified cartilages are situated in the upper abdomen and consist of two parallel, faintly calcified shadows. Vascular calcifications are also uniform but of lesser density and are situ-

ated in the anatomic course of the vessels. In the lateral view, two lines of linear, widely separated calcifications indicate atheroma of the abdominal aorta.

these findings and include them in his report.

2. The direct visualization of the peritoneal lining and of the mesentery by



Fig. 16. C. R., male, 55 years old. Barium and air inflation, showing a small canalized defect of the sigmoid about one inch long. The sigmoid was displaced to the right side, indicating a long mesosigmoid. Pre-operative diagnosis: Early, probably malignant, newgrowth of the sigmoid. Operative findings: Adenocarcinoma of the sigmoid.

CONCLUSIONS

1. Prior to surgery, the indirect symptoms obtained by the visualization of the gastro-intestinal tract are most important for the diagnosis of mesenteric pathology. This is of particular significance in congenital anomalies. The radiologist, therefore, should pay more attention to

means of an opaque medium—thorotrast—is successful in animals. In human beings this is impractical only because of the lack of a suitable opaque medium. Thorotrast is not applicable to human beings because of its late radio-activity, although it could be used in proved malignant lesions of the abdominal cavity.

3. The radiographic differentiation of the inflammatory and neoplastic lesions of

the mesentery has been emphasized. An inflammatory process of the mesentery is indicated by the feather-like appearance of the corresponding segments of the intestines.

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A DIAPHRAGM AND PLATE DIVIDER FOR CHEST ROENTGENOGRAPHY

By CLARENCE J. ZINTHEO, JR., B.Sc., *Richmond Highlands, Washington*

Radiographer at the Firland Sanatorium, Richmond Highlands, Washington

THE usefulness of cones on most radiographic work is quite generally appreciated. However, on chest roentgenograms many laboratories do not use any device to limit the beam of incident radiation, partly because a diaphragm of the proper size and shape is not usually available and partly because the large amount which the density caused by scattered radiation adds to the total density of the film is not widely known. Wilsey (2) has recently indicated that, in making a chest roentgenogram, scattered radiation may amount to 50 per cent or more of the total radiation reaching the film. In an earlier work (3) he found that, aside from the use of a Potter-Bucky diaphragm, scattered radiation from a given body could be reduced, and the quality of the resulting roentgenogram improved most efficiently by decreasing the area of exposure with cones and similar diaphragms. Test plates on chests taken here with a proper shield and compared with otherwise identical exposures of the same patients taken without the diaphragm show a definite improvement which might best be described as a cleaner film of slightly more contrast.

A recent paper by Dr. Rhinehart (1) called attention to the fact that the size and shape of the opening of the diaphragm should be such that the film exposed is just covered. Therefore, a sheet of one-eighth of an inch of lead should have a rectangular opening cut into it of such dimensions that, when it is placed in the proper filter slot of the tube stand, the beam of rays will no more than cover a 14×17 cassette at the distance used (Fig. 1). Conditions are not the same in different laboratories and so the exact dimensions of the opening will vary, but they may be easily computed with the aid

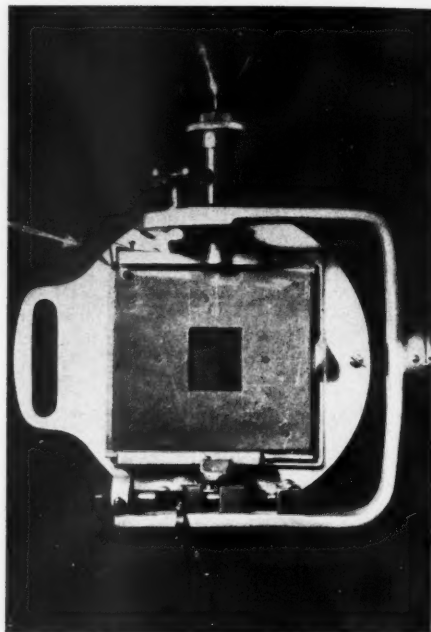


Fig. 1. Diaphragm for chest roentgenography mounted in position.

of Figure 4. The size of the opening in the shield P is given by the equation $P = I \frac{D}{F}$ where I is the dimension of the film covered, F is the focal-film distance, and D is the distance from the focal spot to the face of the shield nearest the film. Thus if the focal-film distance is 60 inches and it is $7\frac{1}{4}$ inches from the focal spot to the shield, an opening of $1\frac{3}{64} \times 2\frac{3}{64}$ inches will just cover a 14×17 film. An inch or so margin to spare should be left around the film—the portal might be cut to $1\frac{3}{32} \times 2\frac{9}{32}$ inches. Such an opening might seem very small to expose all of such a large film, but it will be found to be correct in actual practice.

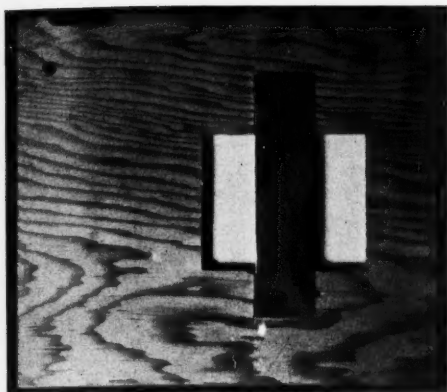


Fig. 2. Plate divider used in combination with the diaphragm to permit unlike technics to each hemithorax.

The sheet of lead is mounted upon a piece of plywood in such a position that when it is pushed all the way in to the filter stop the center of the opening is exactly on the line of the central ray to the mid-point of the film. Under this condition merely to be sure the tube is pointed correctly, *i.e.*, that the central ray is directed to the center of, and is normal to, the film, assures that the coverage is correct. Experience has indicated that a sheet of lead cut to the proper size but not mounted on a wood backing is unprotected from a small amount of banging around, which sooner or later destroys the necessary accuracy of alignment and position.

The Exposure Divider.—Quite often it is desirable and even necessary to utilize a different quality of radiation on one side of the chest than on the other. Thickened pleura on old pneumothorax and other cases, deficient aeration in phrenicotomy with compensatory contra-lateral emphysema, and other conditions may require a small change in roentgen-ray quality to obtain the best roentgenogram of each lung, while thoracoplasties, atelectatic lungs and many other conditions require a comparatively heavy penetration to demonstrate underlying conditions. In the former class of cases a compromise technic is often adopted for a single exposure,

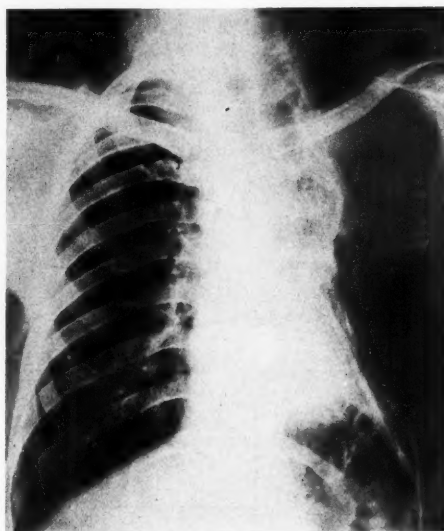


Fig. 3. An example of the use of the plate divider in which the left lung was radiographed with a penetration of 14 K.V. higher than the right. Note the difference in shoulder and neck shadows and the absence of any line of division.

resulting in a plate which on the one side is a bit too dark and on the other too light. With the latter, two plates are often taken, one with a heavy technic for the dense side and the other with a lighter exposure for the more normal condition, in which case one-half of each plate is of no use and represents an economic loss. Though this may be mitigated by cutting a film down the middle (or using 7×17 films) and exposing each half separately to its proper technic, the handling of the parts, in processing, viewing, and filing is bothersome. By using a plate divider such as that shown in Figure 2 mounted in the second filter slot of the tube stand and in combination with the chest shield described above, the proper technic for each hemithorax may be exposed to a single film without affecting the other half.

A strip of sheet lead sufficiently wide to cover something more than half the width of the opening in the chest shield, and whose edges are exactly parallel, is carefully mounted on a piece of plywood perpendicular to the bottom edge. The

position is such that when the right end of the wood mounting is butted to the filter stop in the tube stand, the left edge is

In use, the divider is positioned with the notch butted to the clip and the exposure of the left lung made, the transformer con-

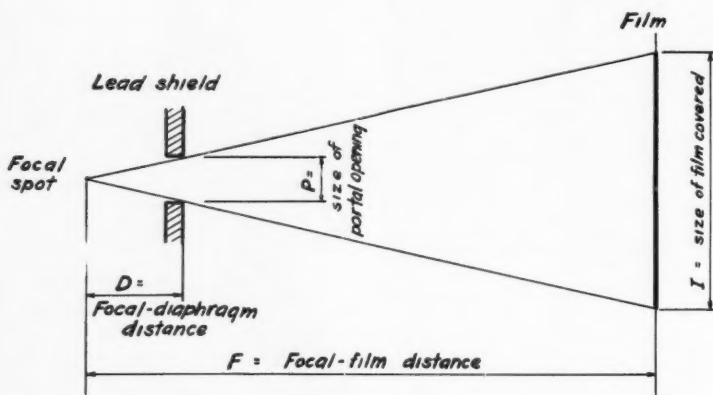


Fig. 4. Geometrical arrangement for computing the size of the diaphragm opening.

exactly opposite the median line of the shield opening or very slightly to the right of this line. A small notch is then cut in the wood so that when the device is drawn out and butted to the clip (seen at the upper left-hand corner of the chest shield in Figure 1) or other similar stop, the right edge of the lead is exactly opposite the median line of the shield opening or very slightly to the left of it.

By making the edges come slightly to the right and left of the median line an overlap of exposure on the chest plate is obtained which should be not wider than one inch. With the patient properly placed, the division of technic is obtained on the spine and mediastinum where the double exposure caused by the slight overlap on the film seems to be an advantage. Figure 3 shows the results of using the divider on a thoracoplasty case in which a penetration of 14 K.V. more was used on the side operated upon. Notice that no line of demarcation between the two exposure technics can be seen. The difference in penetration is demonstrated in the reproduction by the appearance of opposite sides of the neck and the bones of the shoulder.

controls are changed, the divider pulled up to the stop by a string leading to the control booth, and the exposure of the right lung is made. It is found entirely practicable to make both exposures and change the controls while the patient holds the one breath, with a total elapsed time of about five seconds being all that is required. When a magnetic stereo trip is available on the tube stand it may sometimes be adapted to shift the divider.

Some measurements on the transmission of roentgen rays produced by the potential commonly used for chest work through one-quarter inch, 3 ply fir wood, showed a decrease in otherwise unfiltered radiation of 43 per cent in intensity and a change in effective wave length corresponding to filtration with 0.28 mm. aluminum. To eliminate this change, portals of sufficient size must be cut in the wood supports of both the chest shields and plate divider. A piece of black paper over the opening of the chest shield serves to cut off the visible light and prevent a possible sudden start by an unwary patient from the reflected flash of the exposure.

SUMMARY

1. A shield or diaphragm and its method of preparation is described for use in chest roentgenography. Comparison of otherwise identical plates made with and without the shield indicate that its use results in a definite improvement.

2. A divider is described which permits independent use of different exposure technics on each half of a chest film.

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SOLITARY CYSTS OF THE KIDNEY¹

By CHARLES C. HIGGINS, M.D., and EDWARD J. LAVIN, M.D., Cleveland Clinic,
Cleveland, Ohio

THE causative factors involved in the production of solitary cysts of the kidney have been subject to considerable discussion for a long period of time. Cysts of the kidney in general have long been recognized by anatomists. In fact, they were described by Fabry of Hilden who died in 1624, and have been studied by other distinguished anatomists, including Willis and Morgagni. However, the exact etiology has never been satisfactorily determined.

Etiologic Theories.—One etiologic theory explains the development of the cyst on the basis of a mechanical blockage of the collecting tubules, with subsequent retro-dilatation. Other authors contend that it is due to a retention incident to interstitial nephritis. A third theory states that the cyst may be caused by a persistence of the "anlagen or rudiments of uriniferous tubules in the vesicular phase of development and their later expansion." Still another hypothesis is that failure of the S-shaped anlagen of uriniferous tubules to unite with the straight collecting ducts may be the causative factor. The failure of the uriniferous tubules to join the collecting ducts of higher orders (later generations) after having become detached from such ducts of a lower order is also considered as involved in the production of cysts. The belated appearance of disconnected cavities in a uriniferous tubule which had remained solid during its formation has also been presented as an instrumental factor. Finally, the secondary compression of collecting or secretory tubules caused by local inflammatory processes, as congenital syphilis, is considered by others to offer a satisfactory explanation for the production of cysts.

Recently, Hepler (1) has experimentally produced such cysts in the kidney of a

rabbit by fulgurating a papilla and ligating the artery which supplied the same pyramid. He thus produced an obstruction to urinary secretion and an anemia of the obstructed secretory tissue.

Symptomatology.—In many cases, the cyst is relatively small and does not interfere with renal function, and hence produces no symptoms. In such instances, the finding of the cyst is coincidental at necropsy. When the cyst enlarges it may attain sufficient size to exert pressure on adjacent organs, or the presence of a mass may be noted by the patient. Occasionally a dull dragging or aching in the loin or hypochondrium may be experienced. As a general rule, urinary symptoms do not predominate, although in rare instances hematuria has been reported.

Diagnosis.—As stated previously, the small cysts are asymptomatic; no symptoms referable to the urinary tract occur and their presence is not suspected. The larger cysts are usually confused with hydronephrosis, polycystic kidney, ovarian cysts, and occasionally renal neoplasm.

The roentgenogram may show the outline of the cyst, especially if it arises from the lower pole of the kidney and has attained moderate size. A bulging of the cyst into the renal pelvis, producing a deformity, has been reported in some cases in the literature. In certain cases in which the cyst is quite large, a definite difference in density between the cyst and the kidney can be demonstrated on the roentgenogram.

In a previous communication, a case was reported of a large solitary cyst of the upper pole of the kidney which produced downward displacement of the kidney and also definite displacement of the colon. In this instance a difference in density between the cyst and the kidney was noted roentgenographically. The findings on the

¹ Received for publication Oct. 17, 1934.



Fig. 1. Urogram showing a large globular enlargement of the lower pole of the right kidney, and compressing the kidney pelvis above and the ureter toward the midline, diagnosed as solitary cyst of the right kidney.



Fig. 2. Pyelogram of the left kidney showing a large solitary cyst of the lower pole.

pyelogram, therefore, depend on the size of the cyst, its origin, and the direction in which it grows.

In making the differential diagnosis, hydronephrosis, renal neoplasm, and polycystic kidney can usually be eliminated by pyelography, and pelvic examination is of value in ruling out an ovarian cyst with a long pedicle.

Hydrops of the gall bladder and other lesions of the gastro-intestinal tract must also be considered. A complete roentgenographic examination, including cholecystography, can be used to eliminate these conditions.

Pathology.—Beyond the limits of the kidney the cyst wall is usually quite thin; in some instances, it may even be transparent. On the other hand, the cyst wall may be quite thick or even semicartilag-

nous and cases have been reported of calcification of the cyst wall. Blood vessels which are branches of the renal vessels may be seen coursing on its surface.

The fluid content of the cyst is usually colorless, quite clear, and as a rule urinary constituents are absent; traces of albumin are occasionally present. When hemorrhage into the cyst occurs, the fluid assumes a bloody appearance, and subsequently thick colloid masses may form. The cyst wall is closely related to the renal parenchyma and a clear line of demarcation is difficult to perceive in some instances. The renal tissue contiguous to the cyst may present microscopic changes due to pressure, and atrophic changes in the cells may occur. However, the kidney as a whole retains its normal appearance grossly and microscopically.

Treatment.—Various types of treatment have been used in the surgical management

of this condition. These include incision and suture, nephrectomy and excision of the cyst.

1. Incision and suture of the cyst wall to the skin (marsupialization) has been advocated by some surgeons. In this procedure the cyst is incised and the edges of the cyst are then sutured to the skin margin. This procedure is fraught with danger, attended by unsatisfactory end-results, which include the production of an intractable fistula. In view of the excellent results secured by other surgical procedures, we believe that this operation should never be performed.

2. Nephrectomy has also had its advocates. Although in the past the kidney has been sacrificed frequently, in recent years the tendency has been toward more conservative treatment. It is conceivable that the cyst might attain sufficient size, and be so situated that a conservative procedure could not be instituted, but this is most unusual. In the presence of a co-existing lesion of the kidney, such as tumor, tuberculosis, or calculi which has caused destruction of the renal parenchyma, nephrectomy probably is necessary.

In our series of cases at the Cleveland Clinic, there has been only one instance in which nephrectomy was required for the removal of a solitary renal cyst diagnosed pre-operatively. This patient was a child who had an enormous cyst and the remaining functioning portion of the kidney was so small that it was thought best to remove it. In two other cases (Cases 2 and 3, reported here) the kidney has been removed under the impression that the lesion was a neoplasm.

3. Conservative renal surgery is especially applicable in the treatment of solitary cysts of the kidney. An extra-peritoneal approach affords excellent exposure and is preferable to the intra-abdominal route. The cyst wall, although independent of the kidney capsule, is very adherent to it. In some cases by careful dissection the cyst can be removed from the kidney without removing a small

wedge of kidney parenchyma. In many cases, however, the removal of a small wedge of the kidney is necessary in order to insure removal of all the secreting surface of the cyst itself.

The usual kidney incision is made and control of bleeding is secured by digital compression of the renal vessels. By a slight release of pressure, spurting vessels may be ligated or controlled by electro-coagulation. The wedge-shaped margin of the renal parenchyma is easily reapproximated by mattress sutures of chromic catgut.

CASE REPORTS

Case 1. The patient, male, aged 58 years, entered the Clinic on Oct. 15, 1931, complaining of pain in the back, frequency of urination, and pain in the right kidney region. His urinary symptoms dated back two or three years when he first noted nocturia and frequency. One year later, he had begun to complain of a constant pain in the lower back and right kidney area. The pain was occasionally sharp and radiated down the inner aspect of the thigh. For two months the scrotum had been considerably swollen.

When he was examined, he said that he was voiding every two hours during the night, but not so frequently during the day. The urine caused considerable burning and he passed only small amounts at a time. Hesitancy and diminution in the size of the stream had been progressive, and he was annoyed with considerable terminal dribbling. He had lost 28 pounds during the last six months. Dyspnea, and edema of the feet had been present for several years and recently had become more pronounced.

The man had had the usual childhood diseases and pneumonia at the age of twelve years. He said that his mother died of heart disease and that the cause of his father's death was unknown.

The patient was emaciated and cachectic. In the left supraclavicular space, there was a large, hard, fixed gland, which was not tender. The lungs were resonant

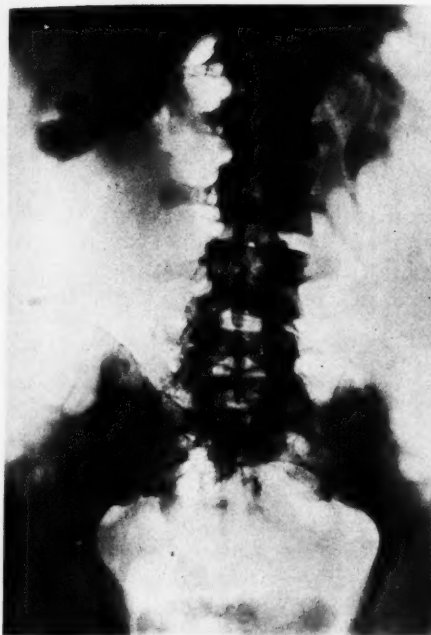


Fig. 3. Urogram showing a normal left kidney pelvis. The right kidney shows hydronephrosis of the cephalic portion of the pelvis, with a large circumscribed tumor mass at the lower pole of the kidney characteristic of a solitary cyst.

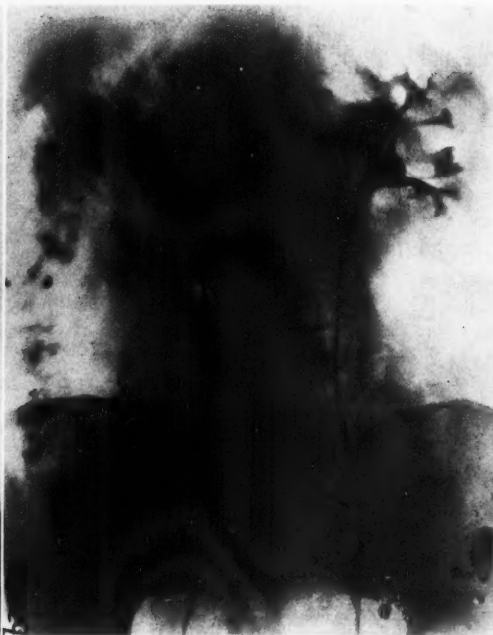


Fig. 4. Bilateral pyelogram showing an anomalous kidney on the left containing a solitary cyst.

throughout, but there were many crackling râles at both bases. The heart was slightly enlarged to the left, but no thrill or murmur was heard. The abdomen was scaphoid, and the liver edge was palpable. Both legs were edematous, with varicose veins. The scrotum was also swollen and edematous. The prostate was enlarged, stony hard, and fixed.

A roentgenogram of the spine showed a metastatic malignancy of the second and third lumbar vertebræ, with rather marked destruction. The urine was normal except for the presence of a trace of albumin and red blood cells two plus. The phenol-sulphone-phthalein test showed 30 per cent return of the dye the first hour and 25 per cent the second hour. There were 4,310,000 red blood cells, 78 per cent hemoglobin, and 11,600 leukocytes. The blood sugar was 88 mgm. per cent and

the blood urea 27 mgm. per cent. The blood Wassermann reaction was negative.

The diagnosis was carcinoma of the prostate with widespread metastasis, especially to the spine.

The patient was hospitalized and roentgen-ray therapy was instituted. One week later he died and the following findings were noted at autopsy: (1) adenocarcinoma of the prostate with metastases to spine, lungs, bronchial nodes, peri-aortic nodes; (2) hypertrophy and dilatation of the heart; (3) hydrothorax (left); (4) small cysts of the spleen; (5) a large solitary cyst of the left kidney, and (6) a small cyst of the left lobe of the liver.

The left kidney weighed 450 grams and measured $17 \times 6 \times 4$ centimeters. There was a solitary cyst 6 cm. in diameter at the upper pole of the kidney which contained clear fluid. The parenchyma of the kidney appeared normal grossly.

In this case no symptoms were present

relating to the cyst which was merely a coincidental finding at autopsy. The presence of a small cyst of the spleen and of the left lobe of the liver were interesting coincidental findings.

Case 2. The patient, male, aged 42 years, entered the Clinic on April 27, 1931, because of blood in the urine, the hematuria having appeared fourteen months previously. At that time he had been subjected to a cystoscopic examination elsewhere, and blood had been reported spurting from the right ureteral orifice. No definite diagnosis was made. Three months before the patient was admitted to the Clinic, a second cystoscopy had been performed by another physician, and again the diagnosis had not been determined. The hematuria had appeared intermittently and had not been accompanied by pain. Two days before admission the hematuria had reappeared and had persisted, and this time it was associated with pain in the region of the right kidney.

The patient was well nourished and well developed. His temperature was 98.6° F., the pulse rate 74, and the blood pressure 115 systolic, 75 diastolic. The right kidney was not palpable and a roentgenogram of the kidneys, ureters, and bladder showed no abnormality. The cystoscopic examination was difficult because of a small meatus. No gross bleeding was noted although the bladder urine was bloody. A Garceau catheter was passed a short distance up the right ureter. The urine collected was bloody and was sent to the laboratory for study. The pyelogram of the right kidney showed a large pelvis with a filling defect in the upper calyx which was attributed to the probable presence of pyelitis with the possibility of calculus or a tumor in the upper calyx.

The catheterized specimen of urine from the right kidney showed a few white blood cells, many red blood cells, and no tubercle bacilli. The catheterized specimen from the left kidney was normal.

The blood count showed 4,960,000 red blood cells, 97 per cent hemoglobin, and 6,400 white blood cells. The blood sugar

was 95 mgm. per cent and the blood urea 27 mgm. per cent. The non-protein nitrogen was 33.6. The blood Wassermann reaction was negative. Urine examination revealed a faint trace of albumin, one plus white blood cells, and three plus red blood cells.

A diagnosis of tumor of the right kidney was made and a nephrectomy performed on May 1, 1931. The patient's convalescence following this procedure was uneventful.

The right kidney weighed 155 grams and measured $11.5 \times 6 \times 3.5$ centimeters. The capsule stripped readily and the kidney was reddish-brown in color, with remnants of fetal lobulations. There were small areas of scarring over the cortex of the kidney. In the upper pole and on the medial surface there was an elevated, thin-walled, grayish-white cystic area measuring 2 cm. in diameter. The cyst contained a brownish fluid.

Longitudinal section through the kidney showed that the cortex and medulla were well differentiated. The depth of the cortex averaged 8 mm. and of the medulla 15 mm.; the pyramids were distinct. The upper calyx was dilated and the mucosa of the pelvis underlying the cystic area was reddened, thickened, and puckered. The remaining mucosa showed small punctiform hemorrhages and roughening of the mucosa. The gross and microscopic diagnosis was solitary cyst and chronic pyelitis of the right kidney.

This case is of interest especially from the diagnostic standpoint. The pyelogram was suggestive of a tumor of the upper pole of the kidney and a definite diagnosis was not established until nephrectomy had been performed. An additional point of interest was that this cyst contained bloody fluid in contrast to the clear fluid usually found in the solitary cysts of the kidney.

Case 3. A man, aged 50 years, came to the Clinic May 7, 1934, to seek relief from kidney colic. One year before he had experienced a sudden severe pain in the left kidney region radiating into the left

groin. Three months later, he had experienced a second attack of more severe pain which again radiated to the left groin. This was associated with nausea and vomiting, so severe that a hypodermic of morphine had been administered to relieve the pain. One week before admission he had another attack which was not so severe as the previous ones. At the time he was examined he complained of a constant aching in his left side. No gross hematuria had been noted and he had never passed a stone or gravel in his urine. His family physician had told him that casts and pus were present in the urine and had prescribed a low protein diet for him.

The patient was well developed and nourished. His temperature was 98.6° F., the pulse rate 80, and the blood pressure 125 systolic, 80 diastolic. A roentgenogram of the kidneys, ureters, and bladder revealed a small stone in the pelvis of the right kidney.

The cystoscope was introduced with fair ease. There was no residual urine and no abnormality in the bladder. Both ureters were catheterized without difficulty. The specimen of urine from the left kidney contained considerable blood, while that from the right kidney was clear. A bilateral pyelogram was done. The right kidney appeared normal and the stone which showed on the roentgenogram was obscured by the pyelographic medium. The left kidney showed a deformity of the pelvis and upper calyx. It was thought that this might be produced by a tumor, probably a hypernephroma.

Laboratory Data.—The blood count showed 4,990,000 red blood cells, with 91 per cent hemoglobin, and 7,400 white blood cells. The blood sugar was 78 mgm. per cent and blood urea 48 mgm. per cent. The urine contained a faint trace of albumin, occasional red blood cells, and occasional white blood cells. The Wassermann reaction was negative. Catheterized specimen from the right kidney showed three plus red blood cells, and one plus white blood cells; from the left kidney, rare red blood cells and no white blood cells.

A diagnosis of tumor of the right kidney was made and nephrectomy was performed on May 24, 1934. Convalescence was uneventful. The specimen of kidney weighed 135 grams and measured 11 × 7 × 4 centimeters. It contained a large cortical cyst at the upper pole of the kidney which was filled with clear, yellowish fluid.

This case is of interest from the diagnostic standpoint for careful urologic studies pointed toward the presence of a renal neoplasm. Another interesting factor in this case was that for a period of a year, the patient had experienced attacks of pain indicative of renal colic. Not until a nephrectomy had been performed and the specimen incised could the presence of a neoplasm be excluded.

(The accompanying Figures 1 to 4 show the roentgenographic findings in cases of solitary cyst of the kidney. These cases illustrated are not reported in the paper.)

SUMMARY AND CONCLUSIONS

1. Three additional cases of solitary cysts are added to the series previously reported (2).
2. Solitary cysts probably occur more frequently than is apparent from reports in the literature.
3. A roentgenogram may reveal the presence of a cyst, especially when it attains considerable size and when a difference in density between the cyst and the renal parenchyma can be noted.
4. The pyelogram may appear normal or the cyst may bulge into the renal pelvis, producing a deformity.
5. Conservative operation with dissection of the cyst away from the renal parenchyma, or the removal of the cyst together with a wedge-shaped portion of the pole of the kidney is advisable.
6. Nephrectomy is rarely necessary unless the cyst is associated with renal tuberculosis, calculi, or tumor.

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OBSTETRICAL ROENTGENOGRAPHY

By JUAN RODRIGUEZ, M.D., *Ft. Wayne, Indiana*

THE demonstration of shadows of fetal bones on the roentgenogram is unquestionably the most positive sign of pregnancy that we have to-day. On the other hand, failure to demonstrate a fetus on the film does not by any means

positive diagnosis of pregnancy, the roentgen ray will determine the presence of a multiple pregnancy, the position of the fetus, abnormalities of the fetus, and even fetal death. Cases of extra-uterine pregnancy (abdominal) at term have been

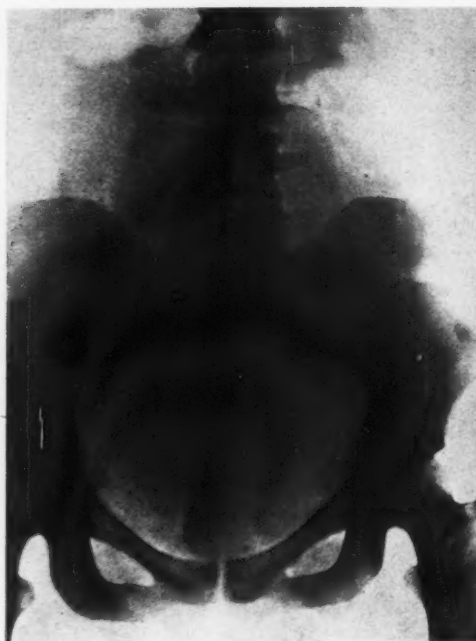


Fig. 1. The patient, at the time of this examination, was five months and eleven days pregnant, yet no fetal bones are demonstrable. A wide separation of the sacroiliac synchondroses may be seen.

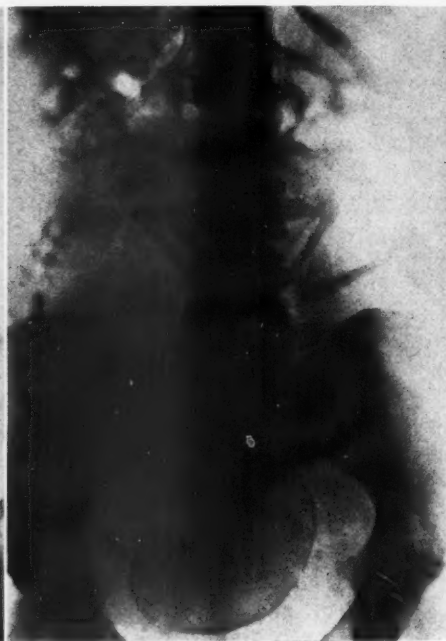


Fig. 2. Same case as shown in Figure 1, taken a month later. Fetus may be plainly seen.

rule out pregnancy even as late as the fifth month, as demonstrated in one of our cases reported below. This latter condition, however, is the exception rather than the rule.

Fetal bones have been shown as early as the third month; they are commonly demonstrated by the fourth month, and should be shown with very few failures by the fifth month. In addition to the

successfully diagnosed by means of roentgenographic examinations.

The films used for the diagnosis of pregnancy should be of the best quality, the screens should be comparatively new and fast, and the patient should have a cleansing enema to rid the colon of gas and feces. Particularly is this true in the early months of pregnancy when we are confronted with the problem of de-



Fig. 3. A ten-week pregnancy. The cranial vault and spine may be seen.

ciding whether a patient is or is not pregnant. A Potter-Bucky diaphragm is essential. The two standard positions, anteroposterior or postero-anterior and lateral, are to be preferred in the later months. Several modifications of these positions have been recommended for the purpose of eliminating the confusing shadows produced by the sacrum and fifth lumbar vertebra.

In the last few years obstetrical roentgenology has taken a decided impetus, judging from the amount of literature on the subject. This advance has been due to the fact that we have developed instruments of precision, and also because the fear of damaging the fetus with the x-ray has been allayed to a certain extent. The obstetrician of to-day has come to realize that the x-ray in competent hands is not as dangerous a weapon as it used to be during pioneering days, and that a good many of the uncertainties with which he comes in daily contact can be made visual images for him. Our own experience has been that whenever the obstetrician has encountered a variation from the normal he has been the first to advise roentgenographic examination for his patient. Occasionally we have had patients



Fig. 4. Anencephaly. Note absence of cranial vault.

who insisted on having roentgenograms made, thus showing that the public is gradually being educated.

Although it is the general consensus of opinion that a fetus is demonstrable at the fifth month, one must not forget the fact that this is not always true, as exemplified in the following case:

Mrs. W. H., age 31, II-para (Fig. 1 and 2), was referred to my laboratory on June 26, 1933. Her physician told me that she was about five months pregnant. She had been feeling well up until two weeks previous to the examination, when she noticed a painful tumor mass in the right quadrant, gradually getting larger. Her physician wanted to know whether or not he was dealing with an extra-uterine pregnancy. The patient gave a history of an uneventful pregnancy and delivery ten years previously. She had not felt "life" and she volunteered the information that she did not see how she could be pregnant, since she and her husband had been practising birth control



Fig. 5. Anteroposterior view of anencephalic monster after delivery.



Fig. 6. Lateral view of same anencephalic monster.

with "medicines and appliances." Upon examination we found a tumor mass, round and boggy, reaching to the level of the umbilicus, and giving one the impression of a five-months pregnancy. Attached to this mass, on the right side, was another smaller, rounded, tender mass about the size of a small fist. A roentgenogram failed to reveal the presence of any fetal bones and a report was given the referring physician that "we could not detect the presence of fetal bones at this stage." The patient continued to have a great deal of discomfort and this, coupled with the negative x-ray findings, influenced the surgeon to open the abdomen although he was very reluctant to do so, and insisted that the patient was pregnant. The laparotomy revealed a pregnant uterus with a fibroid on its right lateral wall. The patient made an uneventful recovery after the myomectomy and, at my in-

sistence she came to my laboratory for another roentgenogram about a month after the first one. This time we demonstrated the fetus. She was delivered on Oct. 15, 1933—the first x-ray examination had been made on June 26, 1933. In other words, she was five months, eleven days, pregnant when I first examined her and yet we could not visualize the fetus.

In contrast with the above case, we were able to demonstrate a pregnancy at about the tenth week (Fig. 3) in a primipara 23 years old. Undoubtedly calcium deposition in the fetal bones is variable, some cases showing it plainly in ten weeks and others going twenty weeks and over without any demonstrable traces. It is, of course, due to this delayed calcium deposition that we have occasional failures at the fifth month.

Anencephaly.—Case (1), in 1917, was the first to successfully diagnose the



Fig. 7. Hydrocephalus. Note the enormous size of the head.



Fig. 8. Neglected transverse. Note the semicircle formed by the spine.

presence of anencephaly before birth by means of the roentgen ray. Since then there have been only 19 more cases reported. The incidence of this condition, five in 1,621 obstetrical cases in the Battle Creek Sanitarium (2) from 1916 to 1926, leads us to believe that these cases are not being reported. Of the five cases reported by Case (2), three were diagnosed *in utero* by means of the x-ray. We have had two in the past year and both were diagnosed before delivery (Figs. 4, 5, and 6).

Clinically, these cases present certain characteristics which will make the experienced and careful obstetrician suspicious of the condition. However, we must frankly admit that a suspicion is not a diagnosis. These cases, with very rare exceptions, can be successfully diagnosed long before the onset of labor and thus the expectant mother may be saved the discomfort of the last few months of

pregnancy and the mental anguish which she would experience on realizing that the child she so carefully and longingly carried for nine (perhaps "stormy") months is a monster. Now that the obstetrician may, without any added discomfort to the patient, and without any fear of injuring either the mother or the fetus, utilize the roentgen ray, it seems reasonable to invoke the aid of this valuable diagnostic means, especially in those cases in which there has been a deviation from the normal course of the pregnancy.

The roentgen findings in anencephaly are characteristic and leave little doubt as to the diagnosis. The absence of the cranial vault, which in the unborn fetus is the most conspicuous part, is pathognomonic of this monstrosity. Spina bifida, often associated with anencephaly, may at times be diagnosed correctly. Doub (3), in 1925, was the first to point

out the presence of spina bifida on a pre-delivery roentgenogram and since then others have demonstrated the condition in like manner.

One of our cases of anencephaly (Figs. 4, 5, and 6) was that of a primipara 27 years old. She was referred for x-ray examination because of an unusually large abdomen which had grown very rapidly in the previous two or three weeks. She was at the time in the eighth month of her pregnancy. Roentgenograms revealed the presence of an anencephalic monster. Her pregnancy was interrupted and she made an uneventful recovery.

Hydrocephalus.—To be forewarned of the presence of hydrocephalus is undoubtedly of great help to the obstetrician. Knowing what he has to contend with, he can then decide the best method of procedure. We believe that hydrocephalus can be accurately diagnosed by the roentgen ray, provided one avails himself of several films in several positions. In this manner exaggeration of the size of the head produced by distance from the part to the film can be eliminated.

Multiple Pregnancy.—Multiple pregnancy, of course, is very easily diagnosed with the roentgen ray. Films made as near delivery as possible are the best because then the obstetrician knows exactly the position and whether either fetus is likely to produce an obstruction or not.

Abnormal Positions.—We have had the opportunity to examine several abnormal positions or, rather, presentations, as the patients were examined either during the first stage of labor or after being in labor for a number of hours without progress. The breech presentation is, of course, easily recognized. In the last

few months we have had occasion to x-ray two transverse positions, one of them the so-called "neglected transverse" (Fig. 8).

Fetal Death.—In 1922, Spalding (4), in a study of 21 fetal deaths, pointed out the fact that overlapping of the cranial bones was pathognomonic of fetal death. We believe, judging from our own observation on two cases, that when overlapping occurs the fetus has been dead for some time.

We have purposely confined ourselves in this discussion to the simpler and safer methods of radiographing the pregnant woman. Pneumoperitoneum has its field, but it really is of greater value in gynecology than in obstetrics. Our present methods of pelvimetry will have to be simplified before they become generally accepted. The injection of an opaque medium is a method which deserves much study and care, and, as we all know, is not as yet a very safe procedure.

SUMMARY

1. The simpler methods of obstetrical roentgenography are discussed.
2. A case of mistaken diagnosis is reported.
3. Anencephalus and hydrocephalus each are discussed and cases reported.
4. Fetal death, abnormal presentations, and multiple pregnancies are discussed.

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GASTROJEJUNOCOLIC FISTULA¹

By L. GRANT GLICKMAN, M.D., *Milwaukee, Wisconsin*

Roentgenologist, Veterans' Administration Facility

THE first case of gastrojejunal fistula reported in the literature was in 1903, by Czerny. Haudek was the first to report the diagnosis of gastrojejunal fistula by roentgen-ray study, in 1912, in a case of carcinoma of the stomach. In 1921, Loewy compiled from the literature 76 cases of gastrojejunal fistula, and in 1925 Verbrugge compiled 102 cases of both gastroduodenal and gastrojejunal fistulas, adding 21 more cases collected at the Mayo Clinic. To date, 250 cases of gastroduodenal and gastrojejunal fistulas have been reported in the literature.

Lewisohn, reviewing the gastro-enterostomy cases at Mount Sinai Hospital, New York, during the period 1915 to 1920, reported the occurrence of jejunal ulcers in 34 per cent. This percentage is considerably higher than the 5 to 10 per cent reported in the German literature; in the latter cases they were eleven times more frequent in men than in women. Verbrugge reports that at the Mayo Clinic the percentage of those having gastrojejunal fistula following gastroduodenal ulcer was 11.36 per cent.

Prior to the popularity of gastro-enterostomy in the treatment of gastric and duodenal ulcers, the classification of causes of gastroduodenal fistula was as follows: first, cancer; second, ulcer; third, gastro-enterostomy; fourth, abscess in the peritoneal cavity; fifth, tuberculosis, and sixth congenital anomaly. With the growing popularity of gastro-enterostomy it was noted that the fistulas due to carcinoma were decreasing and that those due to ulcer were increasing.

Pathology.—The pathology is first that

of a duodenal ulcer; then, following a gastro-enterostomy, an ulcer develops at the stoma and spreads around the jejunum. The ulcer becomes plastered to the colon; later perforates to form the gastrojejunal fistula.

Symptoms.—The four cardinal symptoms of gastrojejunal fistula are: (1) diarrhea (in a patient with a history of an operative procedure for ulcer), which is persistent with soft, yellowish or grayish stools containing undigested food and fat; (2) fecal vomiting, without intestinal obstruction; (3), loss of weight, and (4), eructation of fecal smelling gases.

Signs.—An important sign is the visualization of the fistula by roentgen-ray examination with an opaque enema. In this way a diagnosis has often been made when the condition was not even suspected clinically. Some cases have a fistula with a valve-like formation at the site of communication, so that a contrast meal may not show the condition while a barium enema readily discloses it (Groeschel), or the fistula may be seen at certain examinations and not at others (Haudek). Then, again, some observers have used enemas of methylene blue or carmine and have recovered the dye from the stomach by lavage in from one-half to one hour following the injection of the dye *per rectum*.

CASE REPORTS

Case 1. Male, age 40, white, by occupation a farmer. The *family history* is essentially negative. The *personal history* is as follows: Patient had the usual childhood diseases. At the age of 13 he had an appendectomy. His general health was good up to his period of war service, when he was hospitalized at Bordeaux, France, for stomach trouble in May, 1919. His

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complaint at that time was suggestive of a duodenal ulcer, for which medical treatment was instituted. After his return from service, he was operated on in July, 1919, for a "subacute, perforating ulcer on the anterior and inferior wall of the duodenum just below the pylorus" (operative report). The operation consisted of cauterization of the ulcer and a gastro-enterostomy. The patient returned to his occupation approximately one year after the operation and remained in good health until June, 1929, when he complained of periods of diarrhea. These lasted approximately six to eight weeks, followed by a symptom-free interval for as long as six months. Recurrence of these attacks of diarrhea occurred until the patient reported to this hospital for examination in April, 1931.

Chief Complaints.—Upon admission he stated that he had been troubled with frequent bowel movements, numbering from four to six daily, with the present attack of diarrhea of one week's duration. The stools were soft and no blood was noted. These attacks of diarrhea have been associated with a generalized weakness and the patient believes that he has lost approximately fifteen pounds in weight.

Physical Examination.—Reveals a white male, not acutely ill, fairly well nourished and weighing 150 pounds (normal weight ranges from 165 to 168). The clinical examination was negative with the following exceptions. The breath had a somewhat fetid odor. Blood pressure was 118/82 and the pulse 88. The abdomen revealed a scar to the right of the midline, extending upward from the level of the umbilicus for about five inches, and another scar three inches in length in the right lower quadrant. The abdomen was soft and tender to deep palpation.

Laboratory Examinations.—Urinalysis was essentially negative; blood Wassermann and Kahn tests were negative; hemoglobin, 94 per cent; red blood cells, 5,080,000; white blood cells, 13,700; feces

were negative for amoeba in two examinations.

Radiologic Examination.—Fluoroscopic examination of the esophagus is negative. The stomach reveals the presence of a gastro-enterostomy, and a fairly rapid emptying of the gastric contents into the small bowel. None of the contrast meal can be seen passing through the pylorus. At the sixth hour the greater portion of the meal is within the small bowel and the head of the meal is just entering the cecum; gas is prominent throughout the colon. At the twenty-four-hour examination the cecum and ascending colon are empty, and spastic changes are noted throughout the remainder of the colon. At the forty-eight-hour examination only scattered areas of the opaque medium are seen throughout the transverse and descending colons.

Radiologic Diagnosis.—Fairly well-functioning gastro-enterostomy and spastic changes in the colon.

The patient was placed upon a dietary regimen and medical treatment was instituted, the latter consisting of enemas of neutral acriflavine. This treatment afforded some relief for approximately one month but at the end of that time the symptom-complex of recurrent diarrhea again returned. The patient was then referred for further radiologic observation.

Second Radiologic Examination (May, 1931).—Examination of the colon by means of a barium enema revealed no obstruction to the inflow of the opaque medium. The descending colon in its distal portion filled poorly. The enema reached the last half of the transverse colon, where a portion of the opaque medium was seen to enter the small bowel, while the remainder of the enema passed readily to fill the first half of the transverse colon and ascending colon. Pressure upon the abdominal wall, by the examiner, over the last third of the transverse colon forced the opaque medium farther into the small bowel (no discomfort was experienced by the patient). Continued pressure upon the transverse colon forced more of the

opaque medium into the small bowel and then into the stomach, where it reached the upper portion of the cardia (Fig. 1).

Recheck gastro-intestinal series revealed a large stomach in normal position and the presence of a fairly well-functioning gastro-enterostomy. None of the contrast meal was noted as passing through the pylorus. Thirty minutes after the ingestion of the meal there was a 10 per cent gastric retention and the remainder of the meal was visualized throughout the small bowel. At the sixth hour there was some ileal retention and the remainder of the meal was noted in the ascending colon. At the twenty-fourth hour the entire colon was spastic.

Radiologic Diagnosis.—Gastrojejunocolic fistula with valve present between the large and small bowel, and spastic changes in the colon.

The patient was transferred to the surgical service where he refused operation and was discharged from the hospital upon his own request.

Case 2. Male, age 40, white, by occupation a painter. The *family history* is essentially negative. The *personal history* is as follows: Patient had the usual childhood diseases. History of gonorrhea in 1911, and in the same year (at age of 21) he was operated upon for a ruptured gastric ulcer. His general health then remained good with no history of hospitalization until January, 1927. He had no disability during World War service. He admitted syphilitic infection immediately after discharge from military service; two courses of anti-syphilitic treatment were completed in 1919. The first radiologic diagnosis of duodenal ulcer was made in January, 1927. From January, 1927, until July, 1932, there is a history of seven admissions to the hospital for medical treatment of a duodenal ulcer, and as patient refused surgical intervention, medical treatment was carried out throughout these years. In July, 1932, symptoms became so severe that the patient consented to an operation.

Chief Complaints.—Upon admission to



Fig. 1. Barium enema, described in Case 1, showing the colon, fistula, and the partially outlined stomach. Arrows indicate fistula.

the hospital in July, 1932, the patient stated he had pain over the entire abdomen but more localized in and around the umbilicus. This attack of acute pain had been present for the past three weeks, and was associated with nausea, coming on acutely from one to one and one-half hours following the ingestion of food. The intake of food or alkalies rendered some relief to the pain. Vomiting was frequent but no blood had been noted in the vomitus. No tarry stools were noticed. Generalized weakness has been present for the past three months.

Physical Examination.—Reveals a poorly nourished white male, acutely ill and confined to bed. The clinical examination was negative with the following exceptions. The tongue is slightly coated. The lungs reveal a few scattered râles heard over either base. The heart sounds are weak and indistinct but no murmurs are heard. Blood pressure is 115/75. The abdomen reveals a right rectus scar

and is tender throughout to ordinary palpation, though more marked in the epigastrium and upper left quadrant. Left rectus muscle spasm is present. The muscles are flabby. The genitalia reveal an old scar on the glans penis and a left varicocele. The reflexes are equal and hyperactive.

Laboratory Examinations.—Urine has a specific gravity of 1.025, faint trace of albumin, occasional hyaline casts, 8 to 10 leukocytes per high power field and occasional red blood cell. The stool was yellowish-brown in color and fairly well formed; negative for blood. The fractional gastric analysis was as follows:

Time	Amount	Free HCl	Total Acidity	Lactic Acid	Bile	Blood
Residium	30 c.c.	40°	52°	Neg.	Neg.	Trace
9:00	18 c.c.	46°	60°	Neg.	Neg.	Trace
9:15	20 c.c.	78°	98°	Neg.	Neg.	Trace
9:30	16 c.c.	76°	102°	Neg.	Neg.	Trace
9:45	20 c.c.	80°	104°	Neg.	Neg.	Trace

Blood analysis showed: red blood cells, 4,140,000; white blood cells, 10,600; polymorphonuclears, 62 per cent; small mononuclears, 28 per cent; large mononuclears, 5 per cent; transitionals, 3 per cent; eosinophils, 1 per cent; basophiles, 1 per cent. Wassermann and Kahn tests were negative. Ten sputum examinations were negative for tubercle bacilli.

Radiologic Examination.—Fluoroscopic examination of the esophagus was negative. The stomach was low in the abdomen, with the greater curvature three finger-breadths below the brim of the pelvis. No pathology was noted involving the gastric contour. The duodenal bulb revealed a constant filling defect on the lateral aspect. At the sixth hour, there was approximately a 30 per cent gastric retention, and the remainder of the meal was in the transverse colon which was low on the pelvic floor. At the twenty-fourth hour, the colon was empty.

Radiologic Diagnosis.—Duodenal ulcer with partial obstruction.

Surgical intervention was allowed on July 21, 1932, and the operative findings

were "a large indurated mass, the size of a lemon, distal to the pyloric ring and adhered densely to the pancreas and gall bladder." A posterior gastrojejunostomy was performed, and the patient went on to uneventful recovery, being discharged from the hospital on Aug. 24, 1932.

He continued in fairly good health for several months until he again reported for surgical consultation on Feb. 6, 1933. *Consultant's Report:* "Considerable pain is evident in epigastrium. The patient has a large perforating ulcer which was noted at previous examination and as no appreciable amount of relief from pain was obtained following gastro-enterostomy and in view of considerable pain, high acidity, etc., gastric resection is advisable for gastrojejunal ulcer." The patient refused surgical intervention at this time.

Radiologic examination dated April 5, 1933, revealed the stomach of normal size and position with no evidence of any gastro-enterostomy stoma being noted. Some of the meal was forced through the pylorus. The duodenal bulb was ragged but no filling defect was apparent. At the sixth hour there was a small amount of gastric retention, apparently in the region of the site of the gastro-enterostomy. The remainder of the contrast meal was noted in the terminal ileum and scattered areas of the meal were seen in the colon. The radiologic diagnosis at this time was gastrojejunal ulcer.

The patient again presented himself for hospitalization on Aug. 3, 1933, with the diagnosis of acute intestinal obstruction. The operative findings at this time were "numerous adhesions around small intestine, adhesions of the hepatic flexure to the anterior abdominal wall, large ulcer mass involving duodenum and gastrojejunal junction with perforation into the colon at the site of anastomosis." The adhesions were liberated, and as the mass was too large to resect and too much inflammatory tissue was present, a jejunostomy was performed and the wound closed. Five hours later the patient was

given a transfusion of 500 cc. of whole blood, by the indirect citrate method. The surgical diagnosis was perforating duodenal gastrojejunal ulcer with gastrojejunal fistula.

The patient made a fairly good recovery and further radiologic study was carried out on Dec. 9, 1933. At this time a fluoroscopic examination of the colon revealed some dilatation of the rectum and sigmoid but no obstruction was noted to the inflow of the opaque medium which readily reached the region of the cecum. Adhesions were noted near the mid-point of the transverse colon but no evidence of any fistula could be demonstrated.

Radiologic examination of the colon dated Jan. 25, 1934, revealed no obstruction to the inflow of the opaque medium. No evidence of any intrinsic pathology was apparent. Some evidence of adhesions was noted involving the mid-portion of the transverse colon but no evidence of any gastrocolic fistula was demonstrated.

The patient was referred to the surgical service for further examination as to the advisability of gastric resection, as recommended in February, 1933.

Surgical Consultation Report (Feb. 13, 1934).—"Complaints of pain in back coming on frequently, associated with pain in epigastrium, present in severe degree. Usually more severe at night after meals and usually when bowels are not active. No vomiting at the present time. The present examination reveals extreme tenderness in the epigastrium. The patient has a large perforating mass near the gastro-enterostomy site and the first portion of the duodenum. Further x-ray study is indicated which study patient refuses. Gastric resection is indicated, and as patient refuses he should be carried on medical treatment until permission for surgical intervention is obtained or severity of symptoms will force patient to have surgical intervention."

Patient refused further surgical intervention and will continue on medical treatment.

SUMMARY

Two cases of gastrojejunal fistula are presented in detail, with a short review of the literature.

The first case is of the type described in the literature by Groeschel in which there is noted a valve-like formation at the site of communication of the large and small bowel. This communication was not seen during the examination with the contrast meal but was noted when a barium enema was given, thus showing the presence of the valve at the fistulous opening. In the second case the findings were noted at the operating table and only the end-result (adhesions) was seen in the transverse colon during the fluoroscopic examination of the colon at the time of the barium enema.

One should suspect a fistula in the presence of a persistent diarrhea following an operation for a gastric or duodenal ulcer, associated with symptoms of loss of weight, fecal vomiting without intestinal obstruction, eructation of fecal smelling gases, and visualization of the fistula by roentgen-ray examination or the recovery of dye from the stomach by lavage after the injection of the dye *per rectum*.

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PRENATAL DIAGNOSIS OF LACUNA SKULL

(LÜCKENSCHÄDEL)

By ROE J. MAIER, B.A., M.D., *St. Bernard's and Evangelical Hospitals, Chicago*

THE birth of a monstrosity of some one of the different types is not an uncommon occurrence, but the diagnosis of its existence before birth is far from as common as it should be. Recently H. Dabney Kerr, (1) reviewed the literature on anomalies of the skull in the newborn, with special reference to "Relief" or "Lacuna Skull" (*Lückenschädel*), and presented three new cases. Still more recently Doub and Danzer (2) have reported two more cases, also in the newborn. The author has been unable to find in the literature any record of the diagnosis of this condition before delivery. In the two cases here reported the diagnosis was made during the eighth or at the beginning of the ninth month of pregnancy. This diagnosis can and should be made before delivery in every case in which x-ray examination is available.

The theories concerning the etiology have been so well reported by Kerr and Doub and Danzer that I shall only enumerate them here:

1. Wieland (3).—Ossification cannot keep pace with the rapid growth of the brain during the latter months of pregnancy.

2. Cohn (4).—It is the result of failure to pass a normal phylogenetic stage of development at this particular period.

3. Kassowitz (5).—It is the result of abnormal pressure on the vertex during delivery.

4. Wieland and Faust (6).—It is the result of increased intracranial pressure.

5. Kato (7) and Engstler (8).—It is the result of maldevelopment *per se*.

The theory of Wieland and Faust is supported by the finding of encephalocele, meningocele, spina bifida and other malformations in a very large percentage of



Fig. 1. Case 1. About 8-months pregnancy: microcephaly, "lacuna skull," and spina bifida.



Fig. 2. Case 1. The fetus delivered, showing microcephaly and meningocele.

these cases. In true relief skull, no cases have been found without an accompanying meningocele or encephalocele.

because of a moderate polyhydramnios such as often indicates the presence of some type of monster. The patient was a



Fig. 3. Case 1. Roentgenogram of fetus showing "lacuna skull" and spina bifida.



Fig. 4. Case 1. Roentgenogram of fetus showing "lacuna skull," spina bifida, and deformity of upper six ribs on right side.

X-ray Appearance.—In any film of a pregnancy showing the skull of the fetus the lacunæ or the irregular ossification of the skull is readily visible, and the lateral view of the fetal vertebral column shows an abnormal curvature at the point of the spina bifida and meningocele. This typical appearance is very apparent in the accompanying illustrations.

CASE REPORTS

Case 1. Nov. 14, 1933, Mrs. J. M. was referred to the x-ray department of Evangelical Hospital for roentgen examination

white, American woman, aged 25, primipara. According to her menstrual history she was early in the eighth month of pregnancy. Urine and Wassermann tests were negative. The films revealed irregular ossification of the skull, with markedly decreased bi-parietal and occipito-frontal measurements and an abnormal curvature of the spine. From these films a diagnosis of microcephaly, with irregular ossification of the skull, and spina bifida, was made.

On November 26, twelve days later, labor started and a four-pound, twelve-ounce dead fetus was delivered, although

the heart tones had still been audible the previous day. The fetus had a typical microcephalic head with the following

Case 2. June 25, 1934, Mrs. J. D. was referred to the x-ray department of St. Bernard's Hospital for roentgen pelvim-



Fig. 5. Case 2. Eight-months pregnancy. "Lacuna skull" and abnormal curvature of spine indicating spina bifida.



Fig. 6. Case 2. Photograph of fetus showing meningocele.

measurements: Occipito-frontal, 8.1 cm. as compared with full term average measurement of 11.5 cm.; bi-parietal, 7.7 cm. as compared with full term average of 9.5 cm.; perimeter was 26.5 cm. as compared with full term of 35 cm. There was evidence of an extensive spina bifida with protrusion of the meninges of the cord. X-ray examination showed the absence of sutures and fontanelles nearly closed, extensive convolutional atrophy, and the typical disproportion between the size of the cranium and facial bones. Several of the cervical and upper dorsal vertebrae were fused, with an extensive spina bifida involving the cervical and dorsal vertebrae. There was also an abnormal development of the first to sixth ribs on the right side. Postmortem examination was refused. The mother had an uneventful convalescence and was discharged December 8.

etry. She was a primipara, 33 years of age, white, married twelve years. The last menstrual period had been Nov. 2, 1933. Wassermann, Kahn, and urine tests were negative. Previous menstrual and family history negative; no previous pregnancies or abortions. The patient had osteomyelitis when a child.

The results of roentgen pelvimetry showed normal pelvic measurements. The films showed a skull smaller than normal, however, with many lacunae with dense ribs between and an abnormal curvature of the vertebrae in the lumbar region. From these findings a diagnosis of lacuna skull with spina bifida was made and a poor prognosis for the life of the fetus given.

The patient returned to the hospital for delivery July 9, 1934, and was delivered of a fetus weighing five pounds, three ounces. The skull measurements

at birth were: Occipito-frontal, 10 cm.; bi-parietal, 8.8 cm., with a perimeter of 28.5 cm. There was an accompanying

COMMENT

While the cranial measurements in these



Fig. 7. Case 2. Roentgenogram of fetus showing "lacuna skull" and spina bifida.

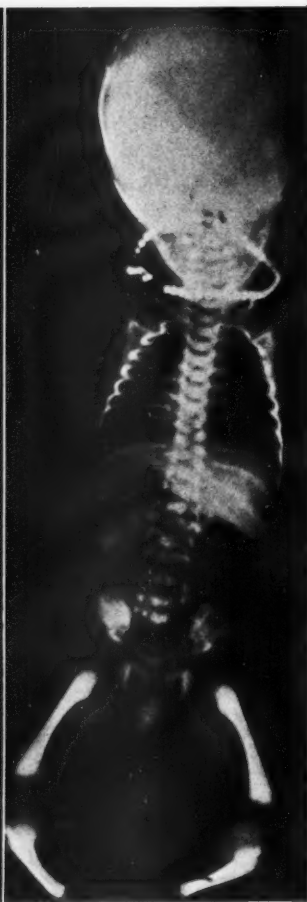


Fig. 8. Case 2. Roentgenogram of fetus showing "lacuna skull" and spina bifida.

spina bifida in the lumbar region. The baby expired July 20, 1934, living eleven days. X-ray examination of the fetus after birth showed the typical lacuna skull, with spina bifida involving the lumbar vertebrae and sacrum. Postmortem examination refused. The mother had an uneventful convalescence and was discharged July 22, 1934.

two cases are below normal, the first even classed as a microcephalic, the lacunae and dense bony ribs separating them are so evident and are accompanied in both cases by spina bifida and meningocele, that the author believes both of these cases should be classed as lacuna skull or *Lückenschädel*. These two cases demonstrate that the abnormalities found in

Lückenschädel are distinctly and readily visible on x-ray examination during the latter months of pregnancy and should present little or no difficulty in diagnosis.

CONCLUSIONS

1. Two cases of *Lückenschädel* diagnosed before birth are reported.

2. *Lückenschädel* can and should be diagnosed as early as the eighth month of pregnancy.

3. Early diagnosis may be of great advantage to the obstetrician in determining his subsequent treatment and procedure.

The author wishes to thank Dr. H. Mackoff and Dr. J. A. Parker for permission to report these two cases.

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CASE REPORTS AND NEW DEVICES

ROENTGENOLOGIC SUGGESTIONS

By WILLIAM R. STECHER, M.D., and THOMAS P. LOUGHERY, M.D., Philadelphia

Radiological Department, Germantown Hospital

Chest Roentgenography.—The roentgenologist is frequently confronted with the troublesome problem of obtaining satisfactory roentgenograms of the chest, in a patient who is manifestly too ill to stand up or even be seated upon the edge of the bed in front of the cassette changer. Prior to the development of the device to be described, the alternatives were,

either a portable bedside roentgenographic examination, or the utilization of an unsatisfactory, relatively short focal-film distance in the roentgenographic room, allowing the patient to lie in bed. Since it is almost *sine qua non* to employ a long focal-film distance, in order to minimize the degree of magnified distortion, the following ingenious device has been designed to enable the operator to employ a six-foot focal-film distance, with the patient lying recumbent in bed. Furthermore, stereoscopic or single films can be made with this device.

The essentials of the apparatus as illustrated in Figure 1 can be concisely described, as follows: A tube holder taken from an old unused tube stand is fastened upon the apex of a substantially constructed stand, the base of which is attached upon the parallel arms of the tube stand of the roentgenographic table. The target of the tube mounted in the device is placed exactly three feet or two feet above the target of the tube in the original tube stand of the roentgenographic table, depending on whether the original maximum focal-film distance is three feet or four feet. Since the mean distance between the parallel supporting bars of the original tube stand is 12 inches, one can compute the spread of the beam of x-radiation. Thus, when employing a six-foot focal-film distance with the extension device equal to three feet, there is a 24-inch spread permitted in the caudad-cephalad dimension of the chest; and a 36-inch spread if a two-foot extension upon an original four-foot focal-film distance is used. It is apparent that this allows ample unobstructed x-radiation to properly cover a 14 X 17 chest film, even when employing a 6-inch stereo-shift.

The numerous advantages of radiography of the chest, when employing this device, are enumerated as follows:

(1) The original tube in the radiographic tube stand can be used, if desired. For this work, it is preferable, although unnecessary, to use the modern metallic discharging chamber type of tube, inasmuch as the considerable additional and excessive weight is reduced by eliminating the heavy leaded glass protective bowl, and yet preventing a considerable amount of stray x-radiation.

(2) The device can be easily and rapidly adjusted and removed from the standard tube stand arms, and yet securely mounted. The original tube stand is pushed out of the way toward the vertical supporting bar.

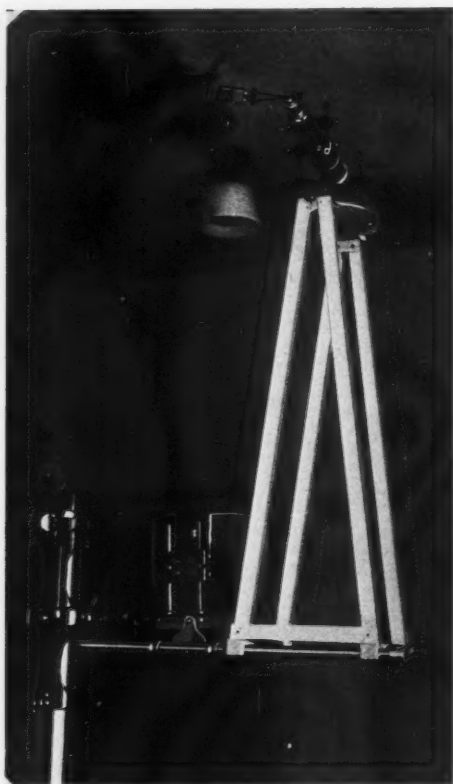


Fig. 1. Showing device mounted upon the standard cross-arms swung out away from radiographic table, to allow the bed to be wheeled alongside the table beneath the tube. Note the wooden rod with hook over high tension wire to anode, which prevents spark jumping to near-by high tension tubular conductor. Also, note lead diaphragm and glass filter beneath tube stand of the device. The entire weight of the attachment is approximately four pounds. Base of device is firmly fastened to the cross-arms of tube stand by means of hook and eyes which are attached to the lower four corners of the device.

(3) The high tension wires are readily attached by lowering the mounted device, until the tube is within easy reach.

(4) The apparatus, when properly adjusted for an exposure, is practically shock-proof, due to the great distance of the high tension wires from the patient.

(5) Stereoscopic views are readily made by shifting the tube stand, together with the device mounted upon the cross-arms, along the cephalo-caudad axis of the body. Since a 6-inch stereo-shift is proper for a six-foot focal-film distance, it is advisable to tilt the tube so as to effectively cover the desired area.

(6) In radiographing the chest of a patient in the semi-erect position in bed, the tube stand is accordingly tilted to the desired angle, to be determined by the position of the patient propped up in bed.

(7) Any desired focal-film distance is accurately procurable by adding the extended height of the device to the distances upon the calibrated vertical tube stand rod.

(8) An exceedingly useful procedure in chest radiography, when it is deemed inadvisable to move the patient from the bed to the roentgenographic table, consists in swinging the mounted device upon the tube stand outward away from the examining table. The apparatus is then accurately focussed over the chest of the patient lying in the bed which has been placed alongside the radiographic table.

(9) A useful adjunct in centering the tube over the chest of the patient is the adoption of a glass filter which permits of a localizing beam of light, and with a small circular piece of black paper pasted upon the center of the glass filter, the exact center of the beam is determinable upon the object to be radiographed. It is, of course, necessary to slightly darken the radiographic room. Two thicknesses of ordinary sheet window glass serve admirably for a filter with the equivalent filtration value of 2 mm. of aluminium.

Sacro-iliac Articulation.—The method of detecting and measuring the degree of rotatory motion of the sacro-iliac articulation, as advocated by Chamberlain,¹ has met with favor by many radiologists, especially in the roentgenographic demonstration of the formerly questioned entity of sacro-iliac relaxation. Briefly, the method consists in having the patient bear the entire weight of the body first upon the right lower extremity and then upon the left lower extremity, while he stands facing a vertical Potter-Bucky diaphragm. Utilizing a radiographic cone, two postero-

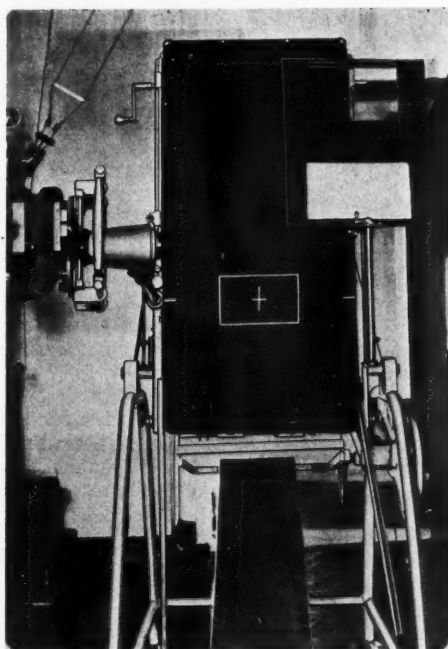


Fig. 2. Genito-urinary radiographic table in vertical position, showing 5 × 8-inch scribed central area. The inclined plane is placed beneath the apparatus. Note the device for shielding one-half of the 8 × 10-inch cassette (placed in the upper right-hand corner of the apparatus), showing protective sheet lead in front and sheet metal back mounted upon a wooden frame having a metal bar at the upper end which facilitates its removal from the grid tray.

anterior projections of the symphysis pubis are obtained, each exposure being carefully marked with R and L lead markers, respectively.

The normal degree of motion of the sacro-iliac articulation as reflected and magnified in the amphiarthrodial articulation of the symphysis pubis is from 0 to 0.5 mm. in the male and from 0 to 1.5 mm. in the non-pregnant female. During pregnancy there is a normal increase in amplitude of motion of both the sacro-iliac and symphysis pubis articulations. It has been found by various reliable observers that the symptoms of sacro-iliac relaxation are almost invariably referred to the side of the high pelvis as seen in the symphysis pubis.

Thus for a complete study of sacro-iliac complaint, five views are desirable. A stereoscopic pair of the entire pelvis with the patient in the dorsal decubitus; one lateral view of the lumbo-sacral junction, and two views of the symphysis pubis employing the technic outlined above. Since many radiologic labora-

¹ The Symphysis Pubis in the Roentgen Examination of the Sacro-iliac Joint, W. E. Chamberlain. *Am. Jour. Roentgenol. and Rad. Ther.*, 1930, **24**, 621-625.

tories do not possess a vertical Potter-Bucky diaphragm, but do have a genito-urinary table in which the grid is an integral part of the apparatus, the following method of procedure can be followed. The patient is elevated or lowered by means of the inclined plane as demonstrated in Figure 2, until the symphysis pubis is positioned exactly upon the scribed area. Since the grid accommodates only a 14 × 17-inch cassette, the accessory contrivance also illustrated in Figure 2 was constructed, which essentially consists of an outer frame made the exact size of a 14 × 17-inch cassette. In this an opening is made to accommodate an 8 × 10-inch cassette. A back of sheet metal is fastened in place, and sheet lead one-sixteenth of an inch in thickness is fastened on the lower front aspect to shield the one-half of the cassette which is inserted beneath it, thus permitting the unshielded half of the film to be in the center of the grid. In this manner, a film area of 5 × 8 inches is also scribed on the surface of the table, to conform to the above. The technic then merely consists in making the first exposure and withdrawing the device, and inverting and reinserting the 8 × 10-inch cassette to make the second exposure. The final result is that two exposures of the symphysis pubis are made upon one 8 × 10-inch film, each respective view marked R and L.

SPONTANEOUS PNEUMOTHORAX IN THE NEWBORN¹

By MILTON J. GEYMAN, M.D., and DANIEL
M. CLARK, M.D., *Santa Barbara, California*

Spontaneous pneumothorax is not commonly seen in children. Scott (4), in a review of the literature in 1929, collected 177 cases in children of various ages. The rarity of the condition during the first year of life, however, is indicated by the fact that Rogatz and Rosenberg (1) could find only 12 recorded cases up to 1931. Since that time about ten more have been reported. The following two cases have come to our attention during the past year.

Case 1. Baby N., white, male, age 4 weeks, admitted to St. Francis Hospital June 24, 1933, on the service of Dr. W. E. Johnson.

Present Complaint.—Cyanosis and difficult, rapid breathing.

Past History.—The infant had a normal delivery. Respiration began without difficulty and apparently was entirely normal. After the customary two weeks' period the child was removed from the hospital in excellent condition.

¹ Accepted for publication July 28, 1934.

Present Illness.—For the past four or five days the patient has had a "cold." On the day of admittance the child suddenly became cyanotic and there was marked respiratory difficulty.

Physical Examination.—The infant is well developed and well nourished. The rectal temperature is 98 and the pulse is 82. Respiration is shallow, rapid, and at times gasping in character. There is a generalized cyanosis, particularly marked around the face and mouth. Expansion of the chest is limited. The percussion note is normal on the right, hyper-resonant on the left. The heart and mediastinum are slightly displaced to the right. Breath sounds are absent on the left. X-ray examination of the chest (Figs. 1 and 2) shows a pneumothorax on the left, with partial collapse of the lung. The visceral pleura is greatly thickened. There is a small amount of free fluid in the left costophrenic angle. The white blood count is 47,500 of which 80 per cent are polymorphonuclears.

Oxygen was administered at intervals but the cyanosis and dyspnea became increasingly worse. The child expired the following day.

Autopsy.—The left pleural cavity contains many adhesions. There is an air-containing space of 5 × 4 × 1 cm. in size. The pleura is heavy and greatly thickened (1 to 2 mm.). No communication with the bronchi is seen. There is a small amount of free pus in the left pleural cavity. The left lung is collapsed and contains no air. The cut surface is a slight beef red, with numerous thick white striae running through it. The right lung has many slightly depressed, non-crepitant areas which extend down into the tissue in a sort of wedge shape. Diagnosis: Bronchopneumonia, pyopneumothorax.

The following case is reported through the courtesy of Dr. J. M. Hayek, of Cedar Rapids, the attending physician, who has placed it at our disposal.

Case 2. Baby C., male, white, age 7 months.

Present Complaint.—Respiratory infection following measles.

Family History.—Negative; three brothers are living and well.

Past History.—Uneventful until two weeks ago when the child contracted measles.

Present Complaint.—Physician was first called on Feb. 16, 1930, and found a child with acute bronchitis and recovering from measles. Two days later physical examination indicated an early bronchopneumonia. The condition grew worse until the day of admission (Feb. 21, 1930).

Physical Examination.—The patient is in a semi-stuporous and very toxic condition. The

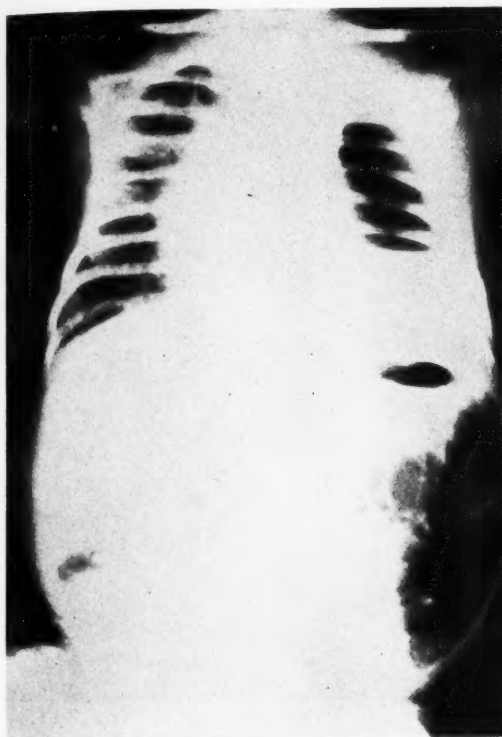


Fig. 1. Postero-anterior view of the chest in Case 1. Note the pneumothorax on the left and the almost complete collapse of the lung. A fluid level is clearly seen.

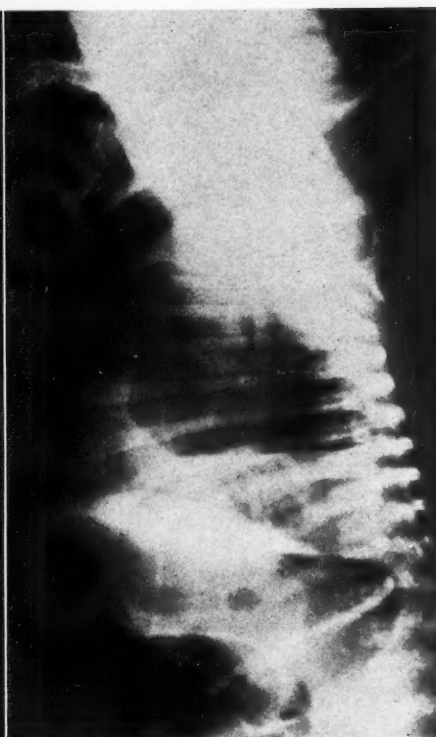


Fig. 2. Lateral view of chest in Case 1. The pneumothorax is plainly seen. The posterior sulcus is obliterated by the fluid present.

skin is sallow, dry, and inelastic. Muscle tone is much diminished. The eyes are sunken and glassy. The abdomen is concave. Typical signs of bilateral bronchopneumonia are elicited on percussion and auscultation. The findings are more marked on the right.

Progress.—On the day of admission 200 c.c. of the father's blood were injected into the jugular vein and peritoneal cavity. Gradual slight improvement was noted until March 7, 1930, when another 200 c.c. of blood was given intraperitoneally. There was a favorable reaction until March 20, 1930, when the child suddenly became much worse. The temperature rose and the pulse was rapid and feeble, and there was moderate cyanosis. X-ray examination of the chest (Fig. 3) showed a right-sided pneumothorax, with collapse of the lung. On March 22, 1930, the pleural cavity was entered with a needle under fluoroscopic control and air was withdrawn until negative pressure was obtained. The next day there was marked improvement but on

fluoroscopic examination the lung appeared to be collapsed. Air was again aspirated until the lung re-expanded. The following day there was continued improvement but the pneumothorax had returned. Aspiration was again employed but only part of the air was removed in the hope that the communication would remain closed. This was again followed by improvement but the lung appeared collapsed the next day. On April 4, part of the air was again aspirated. Improvement followed and x-ray studies four days later (Fig. 2) showed the lung completely expanded. The child was discharged from the hospital three days later in good condition.

COMMENT

Spontaneous pneumothorax in infants may be divided into the following etiologic groups:

(1) Congenital; (2) Mechanical; (3) Traumatic; (4) Infectious.

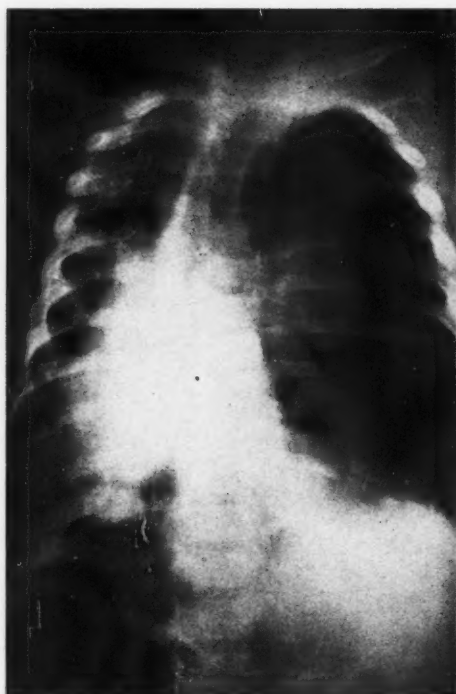


Fig. 3. Postero-anterior view of chest in Case 2. The right lung is completely collapsed and there is a marked shift of the heart and mediastinum to the opposite side. The absence of fluid is a favorable sign.

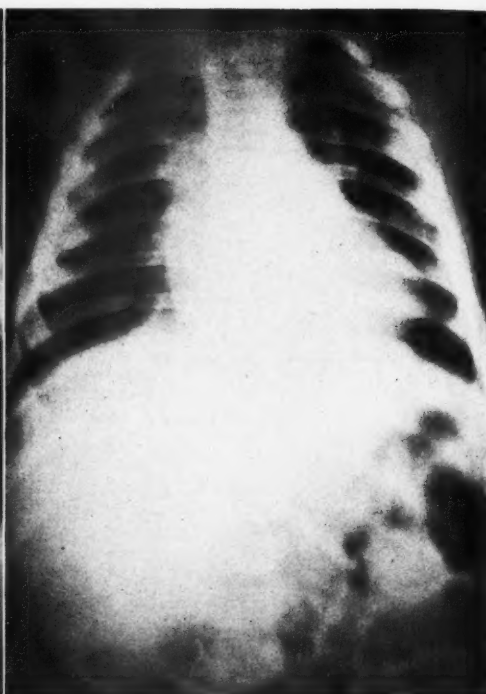


Fig. 4. Case 2. Postero-anterior view of chest after re-expansion of the lung.

Congenital pneumothorax implies an anomaly or defect present during intra-uterine life or at the time of birth, and authentic records of such cases are exceedingly rare. In one case reported by Weiner (6) autopsy showed a communication between a branch of the upper part of the left main bronchus and the pleural cavity—probably a congenital anomaly. When Stein (5) reviewed the subject in 1930 he found four recorded cases which might have been of congenital origin, and added one of his own. He regarded a history of cyanosis or dyspnea present from the onset of respiration as presumptive evidence of congenital etiology. This premise is untenable in view of the lack of autopsy evidence of congenital defect in any of the cases cited.

The mechanical group results from a combination of the muscular effort of respiration and crying with some form of obstruction to the bronchial passages. These cases usually occur shortly after the onset of respiration. Ruge (2) mentioned aspiration of meconium and

vernix caseosa as a possible cause of obstruction. Scheltma (3) suggested collapse of the epiglottis in his case.

Trauma incident to difficult delivery may occasionally be responsible for pneumothorax. The usual sequence is pleural puncture by a sharp fragment of a broken rib or clavicle. Direct injury to the lung has been mentioned as a possibility.

Infection in one form or another is the underlying cause in most cases of spontaneous pneumothorax in infants, pneumonia and tuberculosis being the most frequently mentioned forms, but whooping cough, measles, and scarlet fever may be predisposing factors. In this group, escape of air may result from rupture of a small subpleural abscess or from a localized emphysema. Most of such cases develop empyema, which is a grave complication.

The physical signs are similar to those noted in pneumothorax in the adult but less pronounced. The onset is accompanied by prostration and rapid, difficult breathing. Cyano-

sis is a prominent feature and is most marked about the face and mouth.

The roentgen diagnosis is obvious but the condition must be differentiated from eventration of the diaphragm, diaphragmatic hernia, and congenital absence of the diaphragm.

Treatment is directed toward relief of respiratory embarrassment and control of infection, when present. Administration of oxygen is a valuable sustaining measure. When the amount of air is sufficient to threaten respiratory failure, aspiration should be resorted to. Withdrawal of air usually results in temporary symptomatic relief and, in a few instances, such as in Case 2, has apparently been responsible for ultimate cure.

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1520 Chapala Street

AN EFFICIENT AID IN THE PROCESSING OF X-RAY FILMS DURING THE WARM WEATHER¹

By W. O. WEISKOTTEN, M.D.
San Diego, California

One of the great problems of an x-ray laboratory is the proper processing of films during the warm months if the available supply of tap water exceeds in temperature the safe working limit.

Much has been written relative to this important problem and many methods of water temperature control have been suggested. All of these methods depend on the installation of some form of an elaborate electrical refrigeration plant, costing from \$350 to \$500 or more, which would require an extra room in which to house it. The expense of installation depends on the type of cooling unit employed and the amount of work to be done. If

properly installed according to the accepted methods, these motor driven compressors, with the necessary pre-cooling tanks and mixing valves, are undoubtedly the solution of the temperature control problem for the larger hospital or very busy laboratory if the expense of installation is not a great factor and if extra space close to the dark room is available. Properly insulated tanks are required and the whole outfit must be large enough to deliver a sufficient amount of cooled wash water, thereby reducing the temperature a definite number of degrees, depending on the local conditions which enter into the problem of the individual laboratory.

In smaller laboratories where the volume of work does not warrant the expense connected with an electrically operated cooling plant, and in those laboratories located in office buildings with high rent and without extra available space outside of the dark room in which such equipment may be conveniently installed, some other method of water temperature control must be devised.

Even if the dark room happens to be large enough to accommodate a small motor driven compressor and storage tank, such installation would be impractical because of the heat which is generated and diffused by the cooling unit. The writer tried such an experiment several years ago and learned that it is not possible to extract a given number of heat units from warm tap water without having this same amount of heat diffused somewhere into the surrounding atmosphere by radiation.

Each individual laboratory has its problem of water cooling. After experimenting with numerous more elaborate and costly methods which were far from satisfactory, the writer has successfully developed an inexpensive and simple method of washing films during the warm months.

Our problem probably differs in few respects from that of many laboratories in different parts of the country. We are located in a fourteen-story office building and during the period from May 1 to November 1 the available "cold" water supply varies in temperature from 80 to 85 degrees F.: during the winter months the water temperature ranges from 68 to 72 degrees Fahrenheit. This high temperature during the warm months is due to a natural increase in temperature of the city water supply and also to the fact that in the building the "cold" water pipes parallel the line carrying the hot water supply. Using a standard "Impermo" developing tank, with compartments for the developing and fixing baths and the usual connections for hot and cold water which overflows into the waste through the stand pipe, it is of course impos-

¹ Accepted for publication June 20, 1934.

sible to utilize the "cold" water at a temperature of 82 to 85 degrees for the washing of films. Obviously the temperatures of the

morning 25 pounds of ice are added to the water compartment in preparation for the day's work in the dark room. This amount of

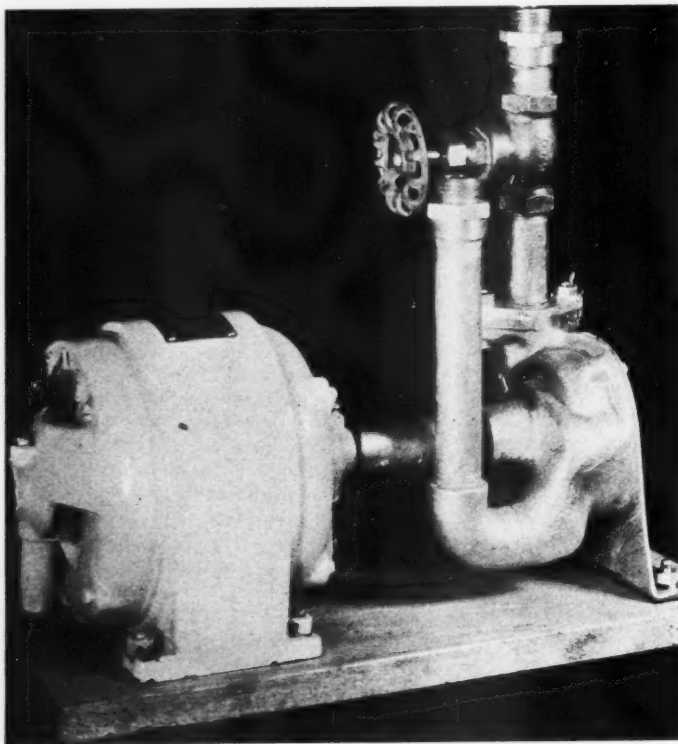


Fig. 1. Simple motor driven centrifugal pump assembly, with standard three-fourths-inch connections for the wash tank.

solutions in the smaller compartments are continuously influenced by the temperature of the wash water.

As previously stated, after experimenting with block ice and a copper coil and later with an electrically operated cooling unit which was not properly installed, the method described below was put into operation with a great deal of satisfaction. This method is far from being ideal but the cost is so small and the results so satisfactory that with our present volume of work, we will probably continue to use this method of film washing until we find something more efficient.

At the end of each day's work the water in the "Impermo" tank is drained off into the waste and the tank is filled with fresh water. During the night this water cools to about 80 degrees; about eight o'clock the following

ice cools the 27 gallons of water in the wash tank to approximately 65 degrees F., and the temperature of the solutions will come down to 68 or 70 degrees, depending on the room temperature. A small motor driven centrifugal pump, with suitable connections to the water compartment of the "Impermo" tank, circulates this cooled water and washes the films in the same manner as when the tap water is run into the bottom of the tank and out through the overflow pipe. The pump takes the water from a three-quarter-inch copper pipe, which extends over the edge of the tank and into the water, to within an inch and a half of the bottom of the tank. The water returns to the tank through a similar copper pipe which extends down about two inches below the water level. The pump is connected to these two copper pipes with suit-

able lengths of common three-quarter-inch garden hose. By actual test this pump, driven by a one-quarter horse power motor connected direct and turning at 1,720 revolutions per minute, will circulate 300 gallons of water per hour through the wash compartment of the tank. This is of course more water per minute than would be used if the films were being washed with water from the supply line.

Theoretically it does not sound reasonable to wash films in water which is being used over and over again, but by actual experience we have found that if the films are thoroughly drained of hypo before being immersed in the wash water, there is not sufficient contamination of this large volume of water circulating through the tank to produce chemical stains on the films. If there are an unusually large number of films to be processed, it is a simple matter to drain the tank at noon, refill with fresh water, and add another 25 pounds of ice. The ice costs less than a couple of 8×10 films and the wash water remains cool during the day.

Prior to the installation of this simple motor driven pump, we cooled the wash water with ice and sloshed the films around until they were supposed to be washed. At the same time, with several films hanging in the tank, we frequently scratched and ruined beautiful films which we were particularly anxious to have come out of the wash water in perfect condition. The whole pump assembly is mounted on a suitable base and rests on a couple of layers of thick felt which absorbs the vibrations and renders the motor pump about as noiseless during operation as an electric fan. A three-fourths "Globe" valve was introduced into the discharge line of the pump as a means of controlling the water circulation. If desired, an extra five-gallon tank of water may be placed beside the hypo tank for preliminary rinsing of films before their immersion in the wash tank. However, we have not found this extra wash tank necessary, and whenever the laboratory work increases to a point at which this present method is not practical we will feel justified in obtaining bids on the installation of one of the more elaborate electrical refrigerating plants.

The accompanying illustration shows the motor pump assembly with a standard three-fourths-inch connection for the supply and discharge lines to the water compartment of the developing tank.

AN UNDIAGNOSED LUNG TUMOR: RESPONSE TO IRRADIATION

By SIDNEY RUBENFELD, M.D., Clinical Assistant
in Radiation Therapy, *Bellevue Hospital, New York City*

From the Radiation Therapy Service, Bellevue
Hospital, Ira I. Kaplan, M.D., Director

That radiation therapy is of little value in the treatment of malignancy of the lung is admitted by most therapists and clinicians. Moderate palliation with but slight alleviation of pain is the most to be expected in the way of relief, and even such results are very infrequent. X-ray therapy has proven of immense aid, however, in treating intrathoracic involvements of the lymphoblastomas; *i.e.*, Hodgkin's, lymphosarcomas, and in leukemias, and in these conditions relief of pressure symptoms is often immediate and even startling.

Accepting as a dictum the extreme resistance of lung malignancies to irradiation, clinicians have eschewed the use of this therapeutic procedure. While this attitude is probably correct in cases in which a definite diagnosis is established by tissue biopsy through the bronchoscope, a clinical diagnosis, even if substantiated by roentgenogram, should never cause the clinician to reject the use of roentgen-ray therapy, because, by so doing, an occasional error in diagnosis may deprive the patient of the beneficial, relieving effects of this form of therapy. An intrathoracic tumor of the Hodgkin's type or a lymphosarcoma or a leukemia or some obscure condition, may present all the symptoms, all the signs, and even the x-ray findings of a malignancy, but often only its response to irradiation can establish its true nature.

Case History. J. W., age 42, white, a meter worker, American, was admitted to the radiation therapy clinic in June, 1932, complaining of pain in the left shoulder region. The condition had commenced two years previously with the simultaneous occurrence of a dry hacking cough and a dull ache in the lower dorsal area, which radiated to the left scapular region and up to the left shoulder. These symptoms persisted for two years without any aggravation. He neither coughed blood nor had night sweats. During the four months prior to admission, he had lost 15 pounds.

The patient did not appear chronically ill; on the contrary, he was very well developed and well nourished. There were no positive clinical findings aside from dullness and numerous coarse bronchial râles in the left upper chest, heard posteriorly. The Wassermann was negative, and the blood count entirely normal. A radiograph taken at the time of admission (Fig. 1) disclosed a homo-



Fig. 1. Film taken on admission. Tumor mass may be seen in upper left lung-field. There is some widening of the mediastinum to the right, and a slight elevation of the left dome of the diaphragm.



Fig. 2. Film taken two months after treatment. There may be seen a slight resolution of the mass. Fibrosis predominates.

geneous decrease in illumination of the upper half of the left lung-field; slight elevation of the left dome of the diaphragm; some widen-

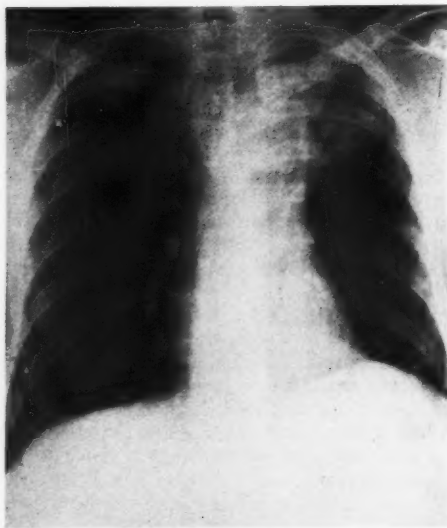


Fig. 3. Film taken four months after admission. There is further resolution: interpreted as fibroid and cavernous pthithis. The patient has greatly improved.

ing of the mediastinum to the right—altogether very suggestive of a neoplastic infiltration. On bronchoscopy, the left upper bronchus was found plugged with thick tenacious exudate, which, on removal, revealed a normal mucosal lining and no tumor growth.

In the absence of tissue biopsy, we established a clinical diagnosis of lung carcinoma, and therapy was instituted with 200 K.V., 4 ma., using an open cone at 40 cm. distance directed to the left lung anteriorly and posteriorly. The dosage was 1,600 r to each area.

Two months after the completion of this first series of treatments, the patient was remarkably improved. He had gained eight pounds, the appetite had become ravenous, and his general well-being made him "feel youthful." Another radiograph (Fig. 2), taken at this time, was interpreted by the x-ray service as fibroid tuberculosis.

With this diagnosis we were inclined to concur because the nature of the response had removed the condition from all likelihood of a malignancy. The tuberculosis service was consulted, but Dr. Amberson and staff were not ready to make a positive diagnosis of consumption. They requested and examined a three-day sputum specimen which, however, did not disclose any tubercle bacilli.

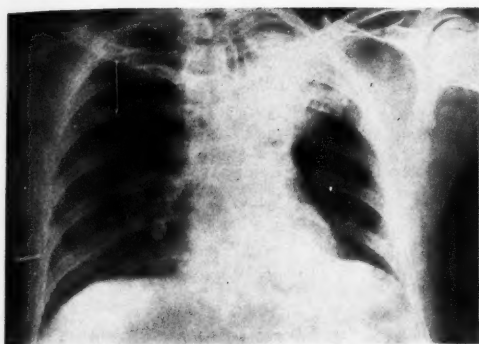


Fig. 4. Film taken one and one-half years after admission. The mass is the same as when first seen. There is marked retraction of the trachea. Also, there is infiltration and fibrosis.

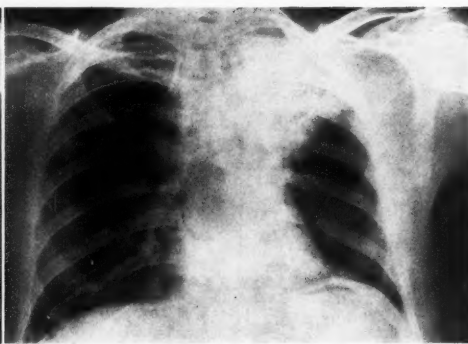


Fig. 5. There may be seen a decrease in density of the tumor mass. Tracheal retraction is persistent (sides reversed).

The initial reaction having been so satisfactory, another series of high voltage x-ray was administered in September, 1932, employing the same factors and attacking the same areas. The radiograph (Fig. 3) at the end of this series was again interpreted as fibroid and cavernous phthisis. It disclosed additional resolution of the tumor mass as compared to Figure 2.

In January, 1933, there was a recurrence of the pain in the left chest and shoulder, and the area was again irradiated as previously. Three months later, April, 1933, the pain was entirely gone, and the general condition of the patient excellent.

During the next eight months, the patient absented himself from the clinic, being free from all symptoms, but reappeared in January, 1934, when the dull shoulder ache returned. A radiograph (Fig. 4) disclosed infiltration, fibrosis, cavitation, and atelectasis, with slight elevation of the diaphragm and considerable retraction of the superior mediastinum and trachea. These findings were again interpreted by the x-ray service as a neoplastic infiltration, and the physicians there were again willing to make that diagnosis. The lesion showed a distinct aggravation compared to Figure 3, and appeared almost similar to the first film. Treatment was again instituted as before, giving 1,200 r to the anterior and posterior chest. The last film (Fig. 5), taken in March, 1934, disclosed a pronounced resolution of the tumor mass. The shoulder pain was entirely relieved and the status of the patient was again that of "feeling youthful."

Summary and Conclusions.—This case is of unusual interest because x-ray therapy was the deciding factor in eliminating carcinoma as a diagnosis. To date, after careful observa-

tion and more detailed clinical work-up, no definite entity has been established, but the patient receives considerable symptomatic relief from the treatments. Furthermore, changes indicative of improvement are evidenced on the films. He has learned to come to the clinic as soon as pains recur, or when his general condition falls below normal comfort. Without x-ray therapy these highly gratifying results would not have been obtained.

We hope this case presentation will serve to further the trial of irradiation when a clinical diagnosis of lung carcinoma, without tissue biopsy, is made.

55 East 86th Street

THE ROENTGENOLOGICAL POSITION OF THE POTENTIAL INTERLOBAR SPACES

AN EXPERIMENTAL STUDY¹

By JOSEPH LEVITIN, M.D., *San Francisco*

From the Department of Roentgenology, Mt. Zion Hospital

The interlobar fissures (potential interlobar spaces) are frequently the site of disease processes. These are usually in the nature of effusions, which may be transudates or exudates. Since clinical signs of interlobar effusions are lacking or difficult to interpret, the x-ray examination may be of great aid in establishing a differential diagnosis between intrapulmonary involvements and effusions into the interlobar spaces. An exact knowledge of the anatomical relationships of the

¹ Supported by a gift from the A. Brown Chest Fund.

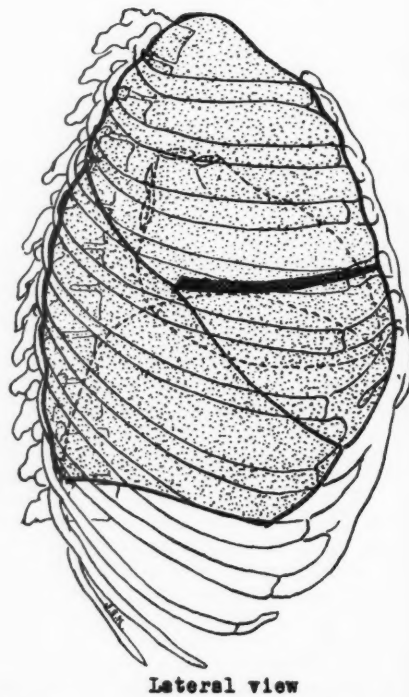
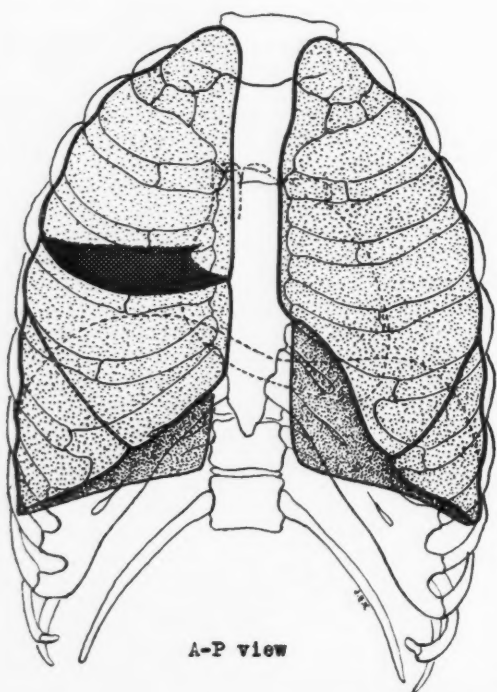
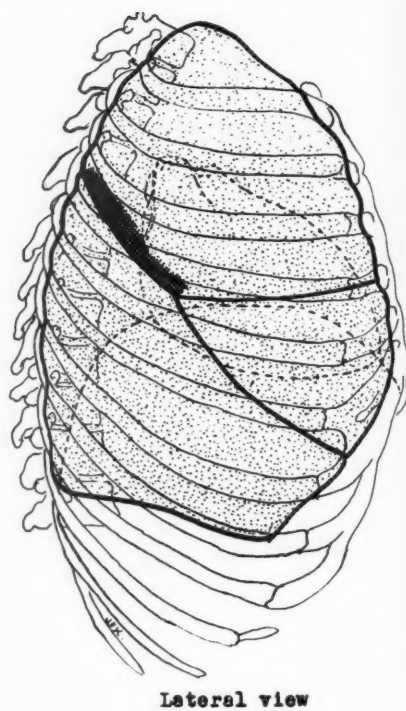
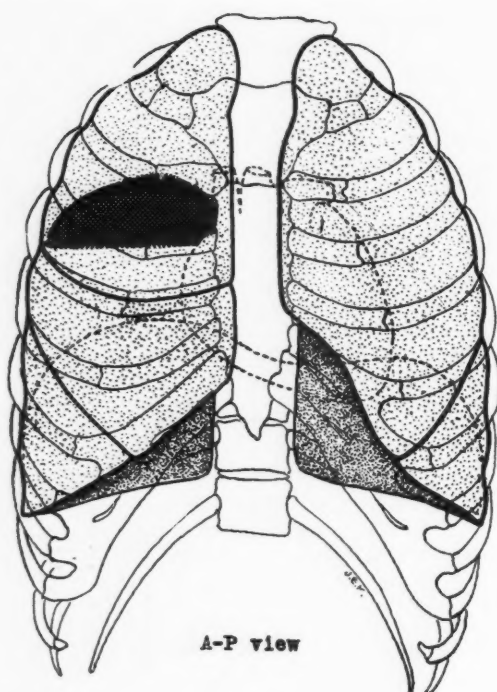


Fig. 1 (above) and Fig. 2 (below)

Fig. 1. Right lung. The x-ray appearance of the potential interlobar space between the upper and lower lobes. The septum between these lobes extends obliquely upward and backward from the hilum. In the anteroposterior view, the lower border is a straight line extending horizontally outward from the hilum to the lateral chest wall. The upper border is convex, corresponding to the contour of the upper limits of the lower lobe. A study of the lateral view demonstrates the oblique course of the septum and explains why the upper border, which actually starts at the level of the fourth rib posteriorly, would, by vertical projection of the x-ray, overlap the second rib anteriorly. The upper and lower lobes approximate each other only posteriorly. (See p. 630.)

Fig. 2. Right lung. The x-ray appearance of the potential interlobar space between the upper and middle lobes. In the anteroposterior view, the upper border is a straight line extending outward from the hilum to the lateral chest wall. The lower border is convex following the boundary of the anterior fissure between the upper and middle lobes. The lateral view shows the septum to lie horizontally, extending forward from the hilum to the anterior chest wall. (See p. 630.)

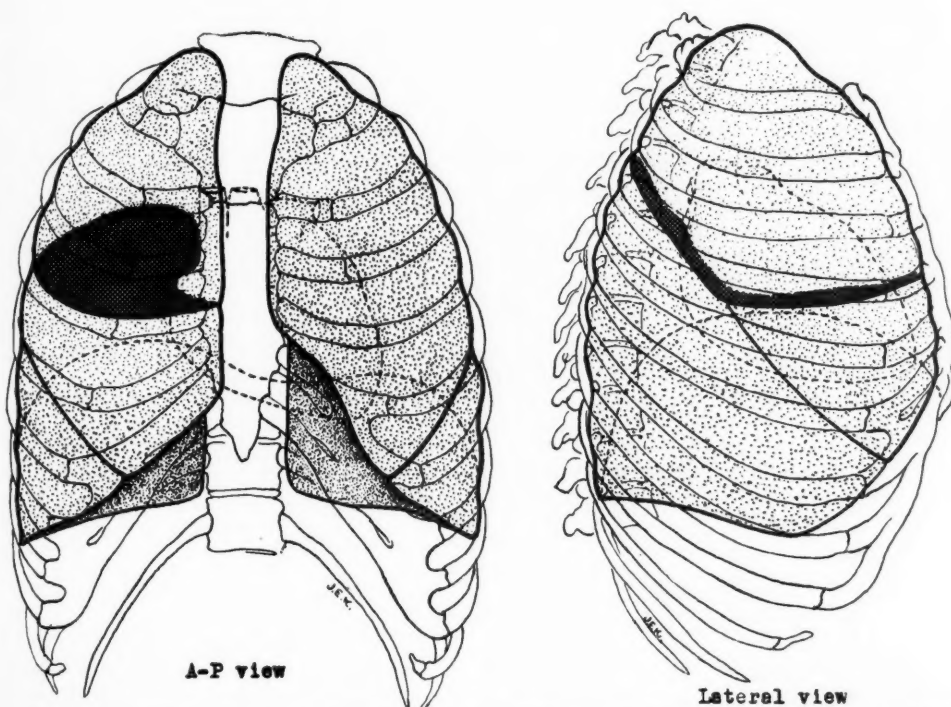


Fig. 3. Right lung. X-ray appearance of the potential interlobar space bounding the entire right upper lobe. This is a combination of the shadows in Figures 1 and 2. The shadow is made up of the septum between the upper and middle lobes anteriorly, and the upper and posterior lobes posteriorly. The shadow in the anteroposterior view is broader and easily mistaken for a parenchymatous involvement. The lateral view aids in establishing the location of this shadow.

potential interlobar spaces as they appear radiologically must be available before abnormal x-ray findings involving these fissures can be interpreted. The study herewith reported was undertaken to establish the roentgenologic position of the interlobar fissures.

The course of the major fissures on both sides is from the level of the spinous process of the third dorsal vertebra posteriorly, obliquely downward and forward to the costochondral articulation of the sixth rib anteriorly. On the right side another fissure extends horizontally

forward from the axilla to the costochondral articulation of the fourth rib. The fissures divide the right lung into three lobes and the left lung into two. On account of their oblique course disease processes involving these fissures which are of sufficient density to cast a shadow will be seen as broad shadows in the postero-anterior view. The exception is that fissure between the upper and middle lobes which lies in the same horizontal plane as the projected x-ray. This shadow will be seen as a narrow band or thin line. In the lateral view the

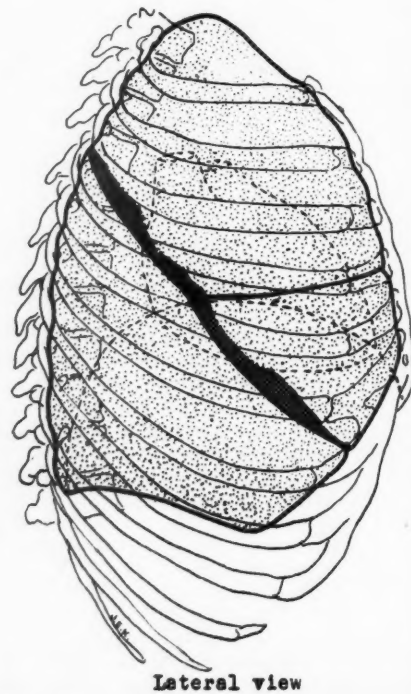
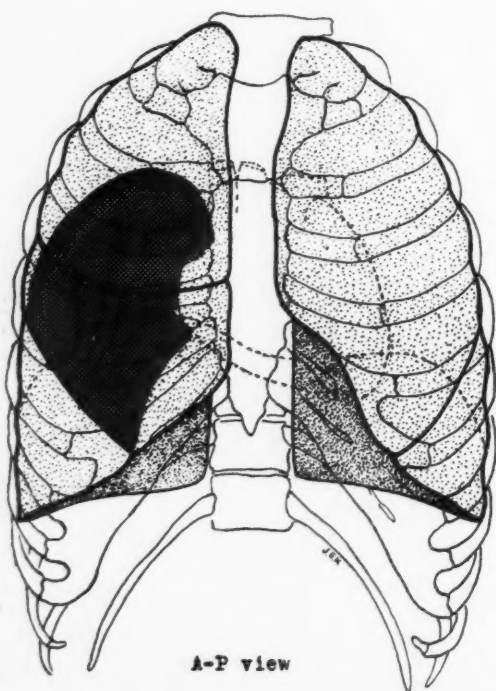
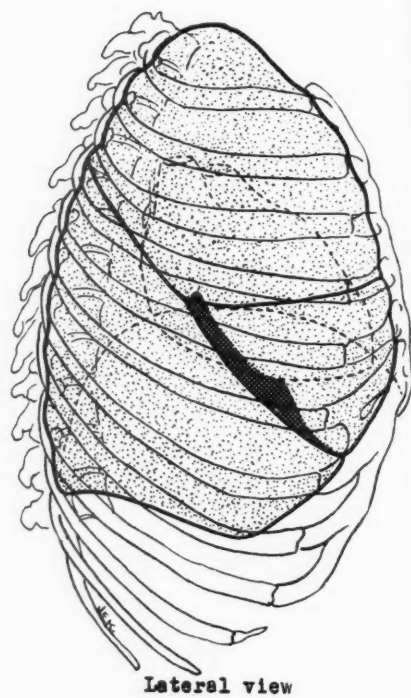
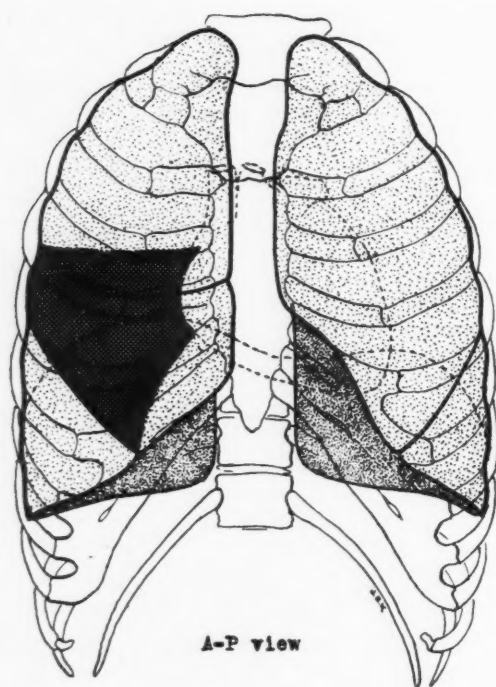


Fig. 4 (above) and Fig. 5 (below).

Fig. 4. Right lung. X-ray appearance of the potential interlobar space between the middle and lower lobes. The appearance of this septum in the anteroposterior view is that of a broad shadow occupying the lower half of the chest, with a horizontal upper border. A small clear area of lung, which is seen in the axilla at the base, represents the lower lobe which in this position extends anteriorly. The differentiation of the shadow, which occupies the entire area of the middle lobe, from a consolidation or atelectasis of the middle lobe can be made from the lateral view. Here we find an almost linear shadow extending obliquely downward and forward from the hilum. This interlobar space is the one most frequently involved by interlobar effusions. (See p. 632.)

Fig. 5. The x-ray appearance of the potential interlobar space bounding the entire upper border of the right lower lobe. This is a combined shadow of Figures 1 and 4. As result of the oblique course of this septum and the broad surface of the lower lobe, the shadow obtained in the anteroposterior view is that of a broad bean-shaped area which might be confused with a lung tumor or a large area of lung consolidation. The lateral view is of aid in establishing the oblique course of this shadow, locating it in the region of the interlobar septum.

A combination of pathologic changes involving all three septa would give a shadow as seen in Figure 5, in the anteroposterior view. The shadow of an additional interlobar effusion between the upper and middle lobes would superimpose itself on the shadow already obtained. The lateral view would clearly demonstrate the position of these shadows between the lobes. (See p. 632.)

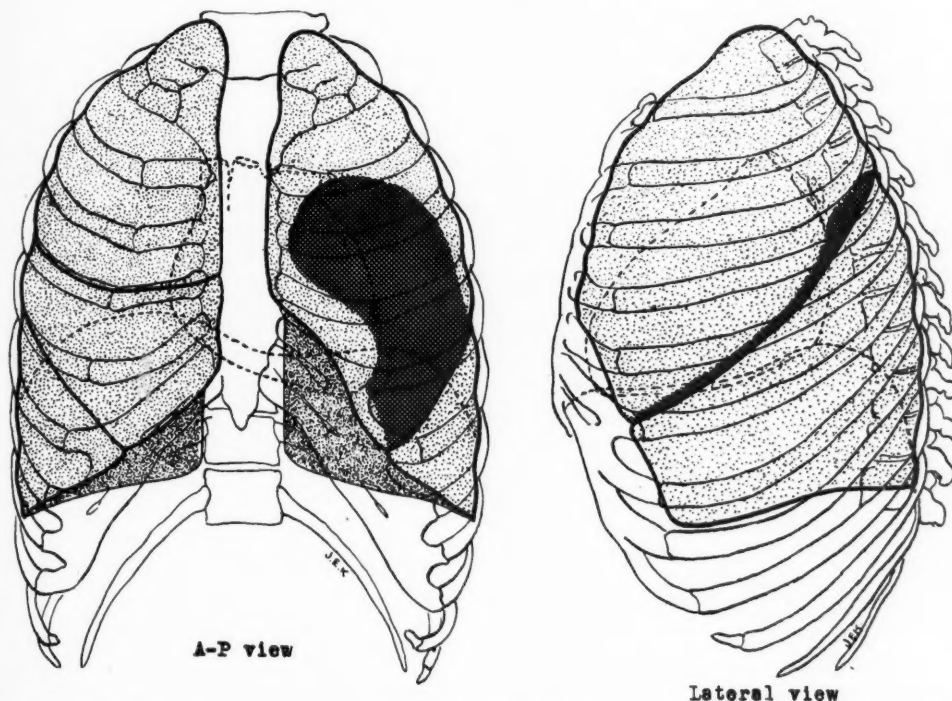


Fig. 6. Left lung. X-ray appearance of the potential interlobar space between upper and lower lobes. With only two lobes on the left side, the possible combinations of superimposed shadows are reduced. The shadow of the entire septum is similar to that of Figure 5. Parts of the septum—as that extending posteriorly—would resemble that of Figure 1. The septum extending from the hilum forward would be similar to the shadow in Figure 4. Abnormal interlobar changes on the left side are not as frequent as on the right.

fissures also appear as narrow bands or lines. In this instance the course of the fissure is in the same plane as the projected x-ray.

Chaoul and Stierlin² suggest taking chest

² Year Book of Radiology, 1932, Charles A. Waters and Ira I. Kaplan, p. 241. Abstract from E. Liebmann, *Lehrbuch der Röntgendiagnostik*, II, Georg Thieme, Leipzig, 1932.

films to define interlobar space disease with the ray directed in several planes. The interlobar effusion will show a broad shadow when the direction of the ray is at right-angles to the plane of the process. The shadow will become narrower as the direction of the ray approaches the plane of the fissure.

Very often we are called upon to make interpretations of x-ray films taken at the bedside.

The condition of the patient may have been such that a complete examination could not be made. A knowledge of the appearance of the fissures in the postero-anterior view would be of great aid in the interpretation of the densities seen on the film. This present study was made for the purpose of providing standard charts of the x-ray position of the interlobar fissures.

Models of the lobes were made of paraffin, which is transparent to the x-ray. The models were fitted into a thoracic skeleton. Lead foil about one-fourth of a millimeter in thickness was placed between the various lobes of the paraffin models and films were taken in postero-anterior and lateral projections. Because of artefacts in the preparation of the skeleton, the roentgenograms obtained were subsequently diagrammed. In the prepared diagrams the position of the heart was indicated by dotted lines. The fissures of the

surface of the lung as seen on the frontal and sagittal surfaces were indicated by a heavy black line. The interlobar fissure studied was indicated by a heavy checkered shadow. A high diaphragm adds to the difficulty of interpretation. At full expiration the diaphragm rises to a height on the plane with the level of the lower border of the fourth rib. This masks a considerable portion of the lung. The diaphragm was indicated on the diagrams at full expiration.

The following diagrams illustrate the location and appearance of the interlobar fissures between the various lobes as they appear on the x-ray film.

The clinical value of these anatomical facts and an interpretive study of pathological intrathoracic x-ray findings is to be presented in a subsequent article. Naturally, partial effusions present only fragmentary pictures of the sort seen in the diagram.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor*

HOWARD P. DOUB, M.D., *Associate Editor*

THE X-RAY PROBLEM AND A SOLUTION

A DISCUSSION OF THE PROPOSED SEPARATION OF THE X-RAY EXAMINATION INTO TECHNICAL AND PROFESSIONAL PORTIONS¹

Genesis.—The immediate cause for the consideration of this problem is the desire or necessity of hospitals to include x-ray and laboratory work with hospitalization in hospital insurance plans. The inclusion of the professional services of the radiologist in such plans of insurance places the hospital in the position of attempting to practise medicine. Desiring to circumvent such illegal practice it occurred, therefore, to some hospital superintendents to separate the x-ray charge into two parts, a so-called technical charge and a professional charge. They propose to give the first along with and as a part of hospitalization and let the roentgenologist charge the second *only* when called in consultation. The real genesis, therefore, lies in the peculiar relationship between hospitals and roentgenologists.

Problem of Dual Interest.—It is perfectly obvious that there are two interests involved in the practice of roentgenology in a hospital. The hospital has an investment in equipment, an interest in rent for floor space, and usually provides technical and stenographic services and supplies to the department. It thus has a definite interest in the money to be collected. On the other hand, the physician practising roentgenology practises his specialty with the use of the equipment and personnel and also has an interest in the money collected.

Division of Dual Interest.—It would seem logical on superficial examination of the subject to divide the fee for x-ray service into two parts, one to cover overhead and one to cover professional service. The difficult problem is where to divide the fees. Some hospitals claim that it is a hospital procedure up to the point of interpretation, that they can produce roentgenograms without any but lay help;

others, having tried this plan realize that the production of adequate roentgenograms requires the services of a roentgenologist and is truly a professional or professional-technical procedure (just as operative surgery is a professional-technical procedure). The following arguments are submitted to show that the hospital actually has no interest beyond the providing of the proper space, equipment, materials, and personnel and *actually should not be allowed to attempt the production of roentgenograms without the services of the roentgenologist*. Fluoroscopic examinations and roentgen diagnoses are assumed without argument to be medical procedures.

Hospitals should not Produce Roentgenograms.—*Firstly*, because the technical work of producing a roentgenogram is a medical procedure.

(a) It involves the penetration of the human body by a very dangerous physical agent. In this sense, it is as much a medical procedure as the administering of drugs intravenously, subcutaneously, or by any way other than the patient's own conscious act.

(b) A knowledge of medical anatomy and at least a working knowledge of gross pathology is necessary to properly direct the angles of projection in order to demonstrate the various parts involved, and in some cases a knowledge of diseases is required really to know what is to be shown.

(c) Medical judgment is required to decide the adequacy or inadequacy of the films obtained.

(d) The making of films is part of the examination of ill, often seriously ill, persons and thus should be under the immediate direction of a physician (roentgenologist).

The statement that the technical side of roentgenography is not a medical procedure originates most frequently from those who are not in close contact with x-ray or hospital de-

¹ Presented by the Executive Committee of the Pacific Roentgen Club, Lowell S. Goin, M.D., *Chairman*; L. Henry Garland, M.D., *Secretary*; John D. Lawson, M.D., Henry Snure, M.D., and Robert S. Stone, M.D.

partments wherein they would see readily how often the roentgenologist is consulted by the technical staff on various cases. When a roentgenologist makes the statement, he always assumes medical supervision. Any act which requires medical supervision is *per se* a professional act.

Secondly, because it is not possible to entrust the entire examination to a lay technician even though we grant that some lay technicians can do a great deal of the work adequately. Credit should be given to roentgenologists that they have been able to train so well relatively inexpensive assistants and thereby lower the cost of radiographic work.

(a) Just as many surgeons' nurses take care of much of the routine surgical dressings and in many of the hospitals assist at operations, but are not allowed to do these same things except under supervision, so x-ray technicians may do many technical procedures but they should be under the supervision and direct control of a medical person.

(b) Any case deviating from the routine requires a medical opinion from a roentgenologist as to whether more studies are needed to elucidate the problem. The value of most roentgenologic departments varies with the amount of time and supervision given by the roentgenologist. Hospitals have realized this in asking for "full-time" roentgenologists.

(c) Same as (c), above, in "Firstly."

(d) Same as (b), above, in "Firstly."

(e) Such a procedure artificially separates the method of examination from the interpretation of results. This sometimes causes serious misunderstandings and mistakes.

(f) Lay-controlled departments have proved unsatisfactory.

Thirdly, because the analogy between surgery and x-ray which has been advanced very often shows the true situation. In surgery, the hospital provides operating rooms, instruments, and nurses but does not attempt to use these instruments. In some medical departments, the hospital provides blood pressure apparatus, stethoscopes, and ophthalmoscopes, but does not attempt to use them. In the x-ray department, by comparison, the hospital may provide x-ray apparatus, rooms, technicians, and clerical assistants but should not use them without medical supervision and, therefore, should not attempt to produce roentgenograms.

Problem of Specialization.—Granting all the above, it could be argued that the attending

physician should be able to direct the x-ray examination. The fact remains, however, that, with few exceptions, he is not able to do so. If he were so able, roentgenology as a specialty would not have developed. The average conscientious physician or surgeon will admit his inability to direct the entire x-ray examinations. X-ray technic in theory and in practice is so specialized that it is not possible to train all physicians in it. Good hospitals do not allow any but qualified surgeons to operate in the surgery. No more should they allow any but qualified roentgenologists to operate in the department of roentgenology.

It might be argued that many of the simpler procedures could be done by a lay technical staff directed by the general practitioner. The fallacy of this is well shown by the average run of films from hospitals in small towns where this is done by necessity.

It is self-evident that if men of any talent are to be attracted to the field of roentgenology so that it can continue to advance, both for the improvement of diagnostic medical practice and for the general good of humanity, there must be sufficient rewards to make it attractive. The surgeon is able to do many minor things without charge because he can collect such large fees for his technical (operative) work. The roentgenologist is not able to collect any such large fees and, therefore, must make small amounts from each examination. If the minor examinations were to be removed from his category, to eke out even a living he would have to charge more for the major examinations.

One practical difficulty in dividing the fee for x-ray service is that with charges of such small denomination, the patients would object to paying two fees. Presuming they paid the hospital fees first, they would assume that they had paid for their roentgenological examination and would not pay an interpretive or diagnostic charge when this was submitted by the doctor. Neither the lay public nor the medical profession has been educated to the two-fee idea.

Conclusions.—The x-ray examination is, and always has been, fundamentally a medical procedure. Roentgenology as a science is still in its infancy. The medical profession as a whole should not stand by idly while short-sighted lay interests and hospitals try to take over this phase of medical practice under the

guise of calling it a technical procedure. The actual operation in surgery is in the same sense a technical procedure; auscultation and percussion are technical procedures; cystoscopic examinations are technical procedures. If all of these are separated from physicians, how will medicine, including radiology, advance or even maintain its present position? X-ray technicians must be trained by physicians. Who will train them when the specialty of radiology no longer exists? This whole proposal of technical division is a retrograde step.

The hospital has a just and proper interest in its equipment, in its space, and in its personnel, but here the interest ceases. It can charge for the materials, interest on investment, salaries, and rental but not for the production of roentgenograms. If the hospital is able to hold out as part of the bait for its insurance policy only the strictly hospital portion of the x-ray examination and if the patient has to pay the recognized roentgenologist for the rest, the bait will not be big enough. There seem to be better ways of protecting the hospital's interest than the division of the medical x-ray examination into two artificial portions. One of these is the maintenance of the quality and soundness of the medical care practised in the hospital; the other is the recognition of the rights of the medical profession, that in the final analysis actually make the hospital what it is—a living institution for the care of the sick *in the hospital*.

ANNOUNCEMENTS

ANNUAL MEETING

ENTERTAINMENT

Among the entertainments planned by our Memphis hosts are the following:

Tuesday: Luncheon for the ladies attending, at the Memphis Country Club.

Wednesday, 10 A.M.: Mrs. McGuffin's breakfast for the Counselors' wives—Georgian Room, Hotel Peabody.

Wednesday afternoon: Musicales and tea given by the ladies of the Memphis Doctors Auxiliary at the home of Dr. and Mrs. Willis Campbell, Morningside Drive.

Thursday afternoon: Sightseeing automobile ride to points of interest. Refreshments served at the home of Dr. and Mrs. W. S. Lawrence, 1622 Central Ave., after the drive.

Thursday evening: Banquet.

The Stag Party will be given at Hotel Gayoso, 8 P.M., Wednesday.

All of the golf clubs in and around Memphis, also hunting and fishing clubs, will be open to the visiting doctors.

Local Transportation.—Due to the proximity of other hotels to the Peabody (headquarters hotel) the local transportation problem is not a serious one. There will always be, however, an ample supply of automobiles and taxicabs in case of inclement weather. For those who come to Memphis by motor, there will be adequate parking garages in connection with all of the hotels.

Rotary Club Luncheon, at which Dr. Wood's address will be given, will be held in the main dining room of Hotel Gayoso at 12:30 P.M., Tuesday, within easy walking distance of Hotel Peabody.

The Carman Lecture will be given in the ballroom of the Peabody Hotel, Tuesday evening.

ANNUAL MEETING

MEMPHIS HOTELS

Location, and additional notice regarding rates

The Memphis hotels are well grouped in the downtown district. All of them are entirely modern, have been kept in excellent shape throughout the depression, and are accustomed to the handling of convention guests. Memphis entertains more than 300 conventions every year.

The headquarters hotel is Hotel Peabody, the rates of which are from \$3.00 to \$5.00 single, \$4.00 to \$6.00 double, and \$6.00 to \$8.00 for rooms with twin beds.

Across the street from the Hotel Peabody is Hotel Tennessee, which provides first class rooms with baths at \$2.00 to \$3.00 single, and \$3.00 to \$4.50 double.

Two blocks away is Hotel William Len, the rates of which are \$2.00 to \$3.00 single, \$3.00 to \$4.00 double, and \$4.50 to \$5.00 for rooms with baths.

At the same distance from Hotel Peabody is Hotel Gayoso, the rates of which are \$2.00 to \$4.00 single, and \$3.50 to \$6.00 double.

Hotel Claridge is located about six blocks from Hotel Peabody. Its rates are \$2.50 to \$3.00 single, \$3.50 to \$5.00 double, and \$4.00 to \$5.00 for twin beds.

The rates at Hotel DeVoy, which is about the same distance from Hotel Peabody as is Hotel

Claridge, are \$1.75 to \$4.00 single, and \$2.50 to \$6.00 double.

Hotel Chisca is about five blocks from Hotel Peabody, and its rates are \$2.00 to \$5.00 single, \$3.00 to \$6.50 double, and \$4.00 to \$5.00 with twin beds.

Next door to the Hotel Chisca is Hotel Adler, the rates of which are approximately the same as those of Hotel Tennessee.

Hotel Ambassador is six blocks from Hotel Peabody, and its rates are \$1.00 to \$1.50 single, \$2.00 to \$2.50 double, and \$4.00 for rooms with twin beds.

Hotel Parkview is located opposite Overton Park in the residential district, about two miles from Hotel Peabody. Its rates are \$2.50 to \$3.00 single, and \$3.00 to \$4.00 double.

The number of reservations to date indicates a large attendance. I suggest that you write for your reservation without further delay in order that you may secure the accommodations desired.

J. CASH KING, M.D.,
Hotel Committee, *Chairman*.

915 Madison, Memphis, Tennessee

TRANSPORTATION FOR THE MEMPHIS MEETING

DEC. 3 TO 7, INCLUSIVE

The Transportation Committee has secured the adoption of the straight certificate plan of reduced fares. At the time the ticket is purchased, each member secures a certificate for himself and each dependent member of his family attending the meeting. He secures this certificate from the agent selling him the ticket and pays the full one-way fare. This certificate is validated at the meeting and, provided 100 certificates are presented for validation, a return ticket may be purchased for one-third the regular fare. No diversification of route is permitted under this plan. All the passenger associations in the United States have agreed to this plan and the Canadian association for the eastern part of Canada. The Committee and the officers of the Society are very anxious for all attending the meeting to avail themselves of this reduced fare.

In the territory of the Southeastern Passenger Association, which is south of the Ohio and east of the Mississippi rivers, there are daily *return* reduced fares that permit of diversified routes. In some instances these

rates are less than the regular fare plus one-third.

Be sure to get your certificate at the time you purchase your ticket.

SCIENTIFIC EXHIBITORS

At the Annual Meeting, to be held at the Peabody Hotel, Memphis, the following Scientific Exhibits have been arranged, according to W. W. Robinson, M.D., Chairman of the local committee on Scientific Exhibits. Others may be added before the final date.

1. Ira I. Kaplan, M.D., Milton Friedman, M.D., and Rieva Rosh, M.D., Radiation Therapy Department, Bellevue Hospital, New York City.

Protracted External Irradiation: Comparison of Different Technics.

2. C. J. Buchner, M.D., and Theodore Fetter, M.D., Jefferson Medical College and Hospital, Philadelphia.

Renal Tuberculosis.

3. H. N. Pulliam, M.D., and L. W. Diggs, M.D., University of Tennessee, Memphis, Tenn.

Sickle-cell Anemia.

4. John R. Evans, M.D., Denver, Colo.
The Obstetric Pelvis.

5. Samuel Brown, M.D., and J. E. McCarthy, M.D., University of Cincinnati, Cincinnati.

The Position of the Esophagus under Abnormal Conditions of the Heart and Great Blood Vessels.

6. A. N. Arneson, M.D., and Edith H. Quimby, M.A., Memorial Hospital, New York City.

Roentgen Radiation in Carcinoma of Cervix Uteri: Distribution of Radiation within the Female Pelvis for Different Port Arrangements and Target-skin Distances.

7. Gentz Perry, M.D., Evanston, Ill.
New Safety Control Devices for Filters in X-ray Therapy.

8. Raphael Pomeranz, M.D., Newark, N. J.
Acute Silicosis Cases in Pulverizing Plants in New Jersey: A Radiologic, Microscopic, and Experimental Survey.

9. I. Seth Hirsch, M.D., New York University Medical School, New York City.
Roentgen Kymography: The Graphic Representation of Visceral Movements.

10. I. S. Trostler, M.D., Chicago.
Differential Diagnosis of Gastric Conditions.
Differential Diagnosis of Pulmonary Conditions.
11. John Russell Carty, M.D., New York Hospital, New York City.
Important Technical Factors in Soft Tissue Radiography.
12. W. E. Caldwell, M.D., H. C. Moloy, M.D., and P. C. Swenson, M.D., Sloane Maternity Hospital for Women, and Roentgen Department, Presbyterian Hospital, New York City.
Anatomical Variations in the Female Pelvis: Their Obstetrical Significance.
13. H. B. Podlasky, M.D., Milwaukee, Wisconsin.
Biliary Colic Fistula.
14. Robert P. Ball, M.D., and S. S. Marchbanks, M.D., Baroness Erlanger Hospital, Chattanooga, Tenn.
Roentgen Pelvimetry and Fetal Cephalometry: A New Technic.
15. T. H. Cuddy, M.D., Winnipeg, Manitoba, Canada.
Unusual Abdominal Lesions.
16. L. F. Fisher, M.D., St. Joseph Hospitals, South Bend and Mishawaka, Indiana.
Diverticula of Colon.
17. E. C. Baker, M.D., and J. S. Lewis, M.D., Youngstown Hospital Association, Youngstown, Ohio.
Multiple Urograms: An Aid to Urological Diagnosis.
18. Byron H. Jackson, M.D., Lewis A. Milkman, M.D., and W. J. Corcoran, M.D., Scranton, Pa.
Lungs of Anthracite Miners of Pennsylvania: All Subjects Working and Apparently in Perfect Health.
19. Chicago Roentgen Society, Chicago.
Century of Progress Exhibit.
20. Walter W. Robinson, M.D., Crisler Clinic, Memphis, Tenn.
A Composite Unit for Sinus-mastoid and Gastro-duodenal Radiography.
21. Leo G. Rigler, M.D., Rudolph Koucky, M.D., and A. L. Abraham, M.D., University of Minnesota, Minneapolis, Minn.
Effect of Thorium Dioxide Sol on the Human Liver: Clinical and Histologic Studies.
22. Leo G. Rigler, M.D., and Lester G. Erickson, M.D., University of Minnesota, Minneapolis, Minn.
Benign Tumors of Stomach: Studies on Incidence and Malignant Degeneration.
23. Lester A. Smith, M.D., Indianapolis, Ind.
Xanthomatosis Involving Bone.
24. Lester A. Smith, M.D., Indianapolis, Ind.
Neurotrophic Bone and Joint Lesions from Myelodysplasia of Spinal Cord.
25. Kenneth D. A. Allen, M.D., and Harold Waltz, M.D., Child Research Council, Univ. of Colo. Medical School, Denver.
A Sign for Evaluation of Inspiration.
26. John D. Camp, M.D., and E. V. Allen, M.D., Mayo Foundation for Medical Education and Research, Rochester, Minn.
Arteriography. Roentgen Visualization of Peripheral Arteries in Living Subjects.
27. Ira H. Lockwood, M.D., Kansas City, Mo.
Tumors of the Breast.
28. Ira H. Lockwood, M.D., Kansas City, Mo.
Bone Tumors.
29. John D. Camp, M.D., Mayo Clinic, Rochester, Minn.
The Roentgen Localization of Spinal Cord Tumors.

COMMERCIAL EXHIBITORS

The following Commerical Exhibitors have requested space to show their products at the Annual Meeting:

1. Buck X-Ograph Company, of St. Louis.
2. Du Pont Film Manufacturing Company, of New York City.
3. Eastman Kodak Company, of Rochester, New York.
4. E. Fougera & Company, of New York City.
5. General Electric X-ray Corporation, of Chicago.
6. Kelley-Koett Manufacturing Company, Inc., of Covington, Ky.
7. Mallinckrodt Chemical Works, of St. Louis.
8. Medical Bureau, of Chicago.
9. Patterson Screen Company, of Towanda, Pennsylvania.
10. Philips-Metalix Corporation, of New York City.
11. Picker X-ray Corporation, of New York City.
12. Radon Company, Inc., of New York City.

13. Standard X-ray Company, of Chicago.
14. Victoreen Instrument Company, of Cleveland, Ohio.
15. Westinghouse X-ray Company, Inc., of Long Island City, N. Y.

EXAMINATIONS BY AMERICAN BOARD OF RADIOLOGY

All radiologists wishing to take the examination of the American Board of Radiology should present themselves for that purpose at the Annual Meeting of the Radiological Society of North America, in Memphis. The exact dates and details may be learned by application to the Secretary of the Board, B. R. Kirklin, M.D., Mayo Clinic, Rochester, Minn., and no time should be lost in getting in touch with him.

COMMUNICATION

MINNESOTA RADIOLOGICAL SOCIETY

The annual meeting of the Minnesota Radiological Society was held in connection with the meeting of the Minnesota State Medical Association in Duluth, Minnesota, July 16, 1934. The following program was presented:

Cholecystographic Findings in a Series of Cases Operated Upon. Edward Schons, M.D., St. Paul.

Osteomyelitis of the Spine, with Case Reports. J. R. McNutt, M.D., Duluth.

The Radiation Therapy of Carcinoma of the Lip. C. O. Hansen, M.D., Minneapolis.

A Roentgenologic Consideration of the Normal Colon. H. M. Weber, M.D., Rochester.

The Roentgen Diagnosis of Placenta Praevia. W. H. Ude, M.D., Minneapolis.

Election of officers for the coming year resulted as follows: *President*, Robert G. Allison, M.D., Minneapolis; *Vice-president*, Eugene T. Leddy, M.D., Rochester; *Secretary-Treasurer*, Leo G. Rigler, M.D., Minneapolis.

The Russell Carman Memorial Lecture was inaugurated at this meeting before the general assembly of the Minnesota State Medical Association. Donald C. Balfour, M.D., of Rochester, delivered a splendid address on the life of Dr. Russell D. Carman and his contributions to radiology. B. R. Kirklin, M.D., introduced A. B. Moore, M.D., of Washington, D. C., who presented an address on "The Function of the Roentgenologists in the Diagnosis of Abdominal Conditions." A similar lecture will be given each year at the meeting of the Minnesota State Medical Association.

BOOK REVIEWS

DILATATIONS OF THE BRONCHI: CLINIC, PATHOGENESIS, DIAGNOSIS, AND TREATMENT (Les Dilatations des Bronches: Clinique, Pathogénie, Diagnostique et Traitement). By MICHEL LÉON-KINDBERG, Médecin des Hôpitaux de Paris. A paper-bound volume of 126 pages, with 20 illustrations. Masson et Cie., Paris, 1934. Price, 22 francs.

This interesting monograph was written by an internist who is regarded as one of the highest authorities in France on bronchiectasis, and who has seen much of the work of André Soulas.

In the introduction is a brief summary of the evolution of the knowledge about bronchiectasis from Laënnec's classical description to the more current views. The author believes that little has been added to Laënnec's original description, and that a study of the development or evolution of bronchiectasis would be of value.

From his large clinical experience he believes that bronchial dilatations result not from one chronic infection of the entire respiratory tract necessarily, but develop from intercurrent infections and complications which flare up and are oftentimes local. They may also be caused by pulmonary tuberculosis, foreign bodies, certain bronchopneumonias, unresolved pneumonias, and above all by abscesses and gangrenous infections. Congenital conditions may play a part. No individual specific organism appeared to be responsible. Several interesting reproductions of microscopic sections are presented showing various phases of bronchiectasis.

Bronchiectasis in infants is more frequent than generally realized and varies from mild to severe cases. There is the acute form observed at or during the course of the primary infection as whooping cough, bronchopneumonia, and respiratory infections following the acute exanthemas. These acute conditions may subside and have only a few focal signs which may characterize the whole condition of chronic ectasis. Following this there is often healing, and then a recurrence which the physician usually thinks of as a new infection unless he understands the true nature of the evolution of bronchiectasis. These so-called "new infections" show the same clinical picture, and are really only a "flare-up" of the old grave infection. The lesions are usually insidious and progressive. Manifestations of

dilatations may be completely absent during the interval before recurrence of the infection, and these cases often are erroneously diagnosed as tuberculosis. Chronic bronchitis *per se* does not seem to be a cause of bronchial dilatations, but any superimposed grave infection, especially if it predisposes to necrosis, may cause a dilatation.

In the adult, bronchiectasis produces a more varied clinical picture than in children. In cases followed for a long time the author believed the primary infection to have occurred a long time previously.

The clinical pictures of bronchiectasis in children and adults are discussed. The symptoms vary from mild to severe and often no classical picture is present to enable a correct diagnosis to be made. The author advocates either roentgenograms of lipiodol injections of the bronchi or bronchoscopy as diagnostic measures. He believes that routine roentgen examinations of the chest are often unsatisfactory, but injection of iodized poppy-seed oil into the bronchi through a nasal catheter followed by a roentgen examination, will show even the very early cases. Several reproductions of roentgenograms illustrating these observations are shown. The second method is the bronchoscopic examination. A figure is shown which demonstrates the various steps in passing the scope. Bronchoscopy is also of use in giving valuable information concerning the condition of the mucosa, anatomical structure, anomalies and abnormalities, and of the presence or absence of neoplasms.

In treatment, the author feels that bronchoscopy is the treatment of choice, especially in early cases. It is palliative and often curative, having another advantage of being practically without risk. Lobectomy, progressive exercises, and collapse therapy have very limited indications.

A bibliography of 181 references, while not complete as the author states, lists many important articles, and may at least be considered as representative of the literature upon this subject.

HAROLD WALTZ, M.D.

THE MANAGEMENT OF FRACTURES, DISLOCATIONS, AND SPRAINS. JOHN ALBERT KEY, B.S., M.D., Clinical Professor of Orthopedic Surgery, Washington University School of Medicine; Associate Surgeon, Barnes, Children's, and Jewish Hospitals, St.

Louis, and H. EARLE CONWELL, M.D., F.A.C.S., Orthopedic Surgeon for the Tennessee Coal, Iron and Railroad Company, Birmingham, Alabama; Orthopedic Chief of the Traumatic and Orthopedic Services of the Employees' Hospital, Fairfield, Alabama; member of the Fracture Committee of the American College of Surgeons, and the Advisory Editorial Staff of "Journal of Bone and Joint Surgery." A volume of 1,164 pages, with 1,165 illustrations. Published by C. V. Mosby Company, St. Louis, 1934. Price, \$15.00.

The authors have produced a volume which covers the more modern methods of treatment of fractures of all types as well as some of the older methods. Their selection of material has been excellent and it is obviously collected from a wide experience in handling fractures in an up-to-date way. It is well organized and the material is presented in a clear and readable manner. The illustrations are well selected and in most instances adequately portray what the authors wish to convey. For the most part the treatment is well described as to all the satisfactory methods in use at the present time.

The references to the literature are in many cases inadequate and in some cases, we believe, misleading. This is perhaps of relatively little importance, and yet, in a reference book of this type, an adequate bibliography, well compiled, is a great help.

The authors have attempted to cover the causes and treatment of the industrial lame back, though we have failed to find any mention of the intervertebral discs in these cases. We believe their importance is worthy of more attention. While the authors mention fractures of the articular facets they have not stressed the importance of traumatic arthritis of these facets in the production of lumbosacral pain with or without sciatica. In another chapter they state that fractures of the sternum are rare. This we question, at least we believe that they are not so rare as indicated. We believe too that more emphasis should be placed on prophylactic administration of anti-gas serum than is found in the text.

In reviewing the work, however, it seems to have as few or fewer shortcomings than most such texts and it is modern and otherwise complete and should be in the hands of every one interested in the treatment of fractures.

LA NÉGATIVATION ÉLECTRIQUE. By P. AUBOURG, Electro-radiologist of the Beaujou Hospital, C. LAVILLE, and P. LE GO. A volume of 146 pages. Masson et Cie., Paris, 1934. Price, 20 francs.

This monograph gives an account of the theoretical considerations leading to the construction of an apparatus called "electropulsator" by C. Laville, with a preliminary report concerning its clinical usefulness. No diagrams of the machine are shown in the text but it is stated that the type of electricity produced has not been employed before. Its three characteristics are set forth by the authors. Extremely small doses of current can be applied; it is possible to measure their order of magnitude with laboratory apparatus. Only the negative pole is utilized, therefore, the name of the procedure as well as the title of the book "Négativation Électrique." The pulsations are modulated, *i.e.*, the ratio between the length of an impulse and the period between impulses is of the order of 1:9.

After an experimental study of the reflexes which may be produced by this new current the authors used it clinically with encouraging results in post-traumatic pain, in neuralgia and neuritis, in painful scars, and in glycosuria. The technical data were usually as follows: 9-12 volts, 70 interruptions per second. It is interesting to note that, for instance, a stomach which usually emptied in six hours, emptied in one and a half hours if this new current was applied to the seventh cervical segment of the spine. The frequency of the contractions was not changed but their strength seemed considerably augmented. The authors also state that "in spite of the small quantities of electrical energy delivered by the apparatus, its therapeutic use can be compared to that of a powerful modifier of cellular metabolism."

E. A. P.

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J. E. HABBE, M.D., of Milwaukee, Wis.

HANS A. JARRE, M.D., of Detroit, Mich.
ERNST A. POHLE, M.D., Ph.D., of Madison, Wis.

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Chronic Idiopathic Steatorrhea: Roentgenologic Observations. A. M. Snell and John D. Camp. Arch. Int. Med., April, 1934, 53, 615-629.

In this condition there are present deficient digestion and absorption of fat which may be attributed to some pancreatic disorder or to some intrinsic lesion of the duodenum or jejunum. The few available observations made at necropsy in these cases tend to substantiate this view. In cases reported by Whipple there were extensive deposits of neutral fat and fatty acids in the intestinal mucosa and in the mesentery and retroperitoneal lymph nodes. Chronic passive congestion and cloudy swelling of the viscera were also noted. In a case reported by Salvesen was found atrophy of the pancreas and spleen as well as parenchymatous degeneration of the liver. Such observations were also confirmed by other writers.

On the basis of these anatomic observations it would appear that, in certain cases at least, it should be possible to demonstrate roentgenologically evidence of disease in the upper part of the intestinal tract, and certain changes have been noted in three of the seven cases reported. The roentgenologic findings consisted of delayed motility and alterations in the mucosal relief of the small intestine, especially the jejunum, producing a smoothing of the contours of the lumen, obliteration of the usual markings of the valvulae conniventes, and clumping of the barium in elongated masses. These roentgenologic findings suggested an inflammatory condition with edema of the mucosa and infiltration of the walls, involving especially the small intestine, and occasionally the stomach, duodenum, and colon. The regression of the changes, coincident with the improvement in the clinical symptoms, and inflammatory changes described at necropsy in similar cases would seem to substantiate the correctness of the observations. It is not held that these roentgenologic observations are characteristic only of chronic idiopathic steatorrhea, since they may occur in varying degrees of any acute inflammatory condition of the intestinal tract. Their presence, however, constitutes tangible evidence during life of alterations in the gastrointestinal tract which has been suspected clinically and found at necropsy in idiopathic steatorrhea.

This paper and the disease-syndrome it describes is important to the roentgenologist because it throws additional light on diseases of disturbed mineral metabolism. In connection with the paper it is noted that three of seven cases discussed presented changes in the skeletal system, especially one case of osteoporosis and a second case with marked osteomalacia, including deformities of the pelvis and long bones and pseudo-fractures.

From the anatomic, physiologic, and roentgenologic evidence presented it is apparent that the clinical syndrome of idiopathic steatorrhea with tetany may be produced by an inflammatory or atrophic lesion of the upper intestinal segments. The element of defective absorption of fat, mineral salts, and vitamins may well be secondary to such lesions. The condition undoubtedly does not constitute a clinical entity. The same

clinical phenomena have been encountered in tropical sprue, which, at recent studies seem to indicate, may be a deficiency disease approximating in some respects primary anemia.

H. A. JARRE, M.D.

GENITO-URINARY TRACT (DIAGNOSIS)

The Diagnostic Significance of Pyelovenous Reflux. R. Töppner. Fortschr. a. d. Geb. d. Röntgenstrahlen, September, 1934, 50, 281-286.

Two cases of so-called pyelovenous reflux are reported. No pathognomonic significance is attached to such observations beyond the indication of a pathologically increased pressure in the renal pelvis which might have been produced by spasm, ureteral occlusion, or faulty injection.

H. A. JARRE, M.D.

HEART AND VASCULAR SYSTEM

The Roentgenologic Diagnosis of Intracardiac Calcifications. Paul A. Bishop and Hugo Roesler. Am. Jour. Roentgenol. and Rad. Ther., January, 1934, 31, 1-15.

Calcareous deposits in some portion of the heart are rather common in individuals over fifty years of age but are often only microscopically visible, or are so scattered as to escape detection by both ordinary and special roentgen examination. When readily visible with the naked eye, they may then often be successfully studied *in vivo* or postmortem by appropriate roentgenologic methods. In the authors' article the term "intracardiac calcification" is restricted to calcification of the left annulus fibrosis and mitral and aortic valves. Roentgenoscopy is an important part of the study for the character and extent of the movements of these areas of calcification and is very helpful in determining their structural location. An elliptical, "dancing" or "jerking" motion, varying in speed and covering a distance of 0.8 to 1.5 cm., is described as characteristic. It is the authors' belief that such changes are more often on a degenerative rather than an inflammatory basis (fatty degeneration, necrosis, atheroma, calcification), of the skeletal connective tissue of the heart which is interposed between atria and ventricles and serves for insertion of atrioventricular valves, aorta, and pulmonary artery.

For radiographic demonstration a Rotalix tube is preferred which allows rapid exposure and gives fine detail. The pre- and postmortem radiographic appearances of the three cases reported are included in the illustrations.

J. E. HABBE, M.D.

Radiography of Calcification in Cardiac Valves during Life. J. V. Sparks and Courtenay Evans. British Jour. Radiol., August, 1934, 7, 463-466.

The authors discuss the clinical examination and radiologic demonstration of calcification in the heart

valves and describe the radiographic technic used to visualize the lesion.

The patient was a married woman, aged 52 years, who complained of occasional pains in the sternal region of twenty years' duration. Giddiness and shortness of breath at times also were noted by the patient. Physical examination revealed slight enlargement of the heart, a systolic thrill in the second right intercostal space, an apical systolic murmur and a faint diastolic murmur along the left border of the sternum. The radial and brachial arteries were thickened. The blood pressure was 170/130 mm. Hg. and the pulse rate was 68. The blood Wassermann reaction was negative. The clinical diagnosis was aortic stenosis with arteriosclerosis and hypertension.

Fluoroscopy revealed evidence of enlargement of the aortic arch. With the patient in a semi-oblique position a well-marked comma-shaped area of calcification was visible in the position of the aortic valve. The upper portion of the shadow appeared fixed and the lower end moved about a centimeter at each cardiac impulse. The shadow was noted in both oblique positions and also in the left lateral position.

In order to visualize calcification in the heart valves the authors advise adequate accommodation of the eyes, and the use of a sufficiently small diaphragm. The radiographic demonstration is more difficult because of movement. A high milliamperage, a small cone, and a very short exposure time are suggested.

J. N. ANÉ, M.D.

Interatrial Septal Defect. H. Roesler. *Arch. Int. Med.*, September, 1934, **54**, 339-380.

A case is reported which illustrates the clinical and anatomic peculiarities of interatrial septal defects. Sixty-two cases have been reviewed, including the author's. All of the cases of small defects or complete absence of the interatrial septum and combinations, with patency of the ductus arteriosus, pulmonary stenosis, interventricular septal defect, and a high grade of coarctation of the aorta, have been excluded.

In at least three-fourths of all the cases valvular lesions were found which affected predominantly the mitral orifice. Subacute bacterial endocarditis did not occur; chronic pericardial disease, crossed embolism and tuberculosis of the lungs occurred rarely.

The roentgenologic findings were those of a large heart varying in shape from oval to globular, and extending, as a rule, toward the left. The pulmonary conus and artery projected far to the left, and upward and forward. The branches of the pulmonary artery (the "hili") at times showed increased pulsations and were sharply defined and enlarged. Lack of knowledge of the roentgenologic picture led to the erroneous diagnosis of mediastinal tumor or tuberculosis. The aortic knob was small—at times invisible. Other conditions which caused pulmonary dilatation and narrowness or absence of the aortic knob, were given.

The interesting finding from the electrocardiographic study was the presence, as a rule, of only a moderate

degree of axis deviation to the right. Enormous dilatation of the right side of the heart with comparatively moderate hypertrophy did not cause a high degree of right axis deviation in the electrocardiogram.

H. A. JARRE, M.D.

Coarctation or Congenital Stenosis of the Aorta Elizabeth Foley Taylor. *British Jour. Radiol.*, August, 1934, **7**, 452-462.

Coarctation or congenital stenosis of the aorta in the region of the ductus arteriosus may be divided into the "infantile" and "adult" types. In the "infantile" type the aorta is narrowed where the ductus arteriosus joins this vessel. The "adult" type, in which there is complete stenosis or extreme narrowing, was described in 1828 and 1844 as postmortem curiosities. At the present time, this condition is recognized as a clinical entity which can be diagnosed radiologically.

Adult coarctation may produce no symptoms as long as the collateral circulation is sufficient to supply the needs of the body. However, with weakening of the myocardium as a result of intercurrent infection or increase in the hypertension in the upper parts of the body as a result of excessive muscular strain the condition may become evident between the ages of twenty and forty years.

Well-established cases of coarctation of the aorta may be recognized clinically. In the more obscure cases the radiological examination is considered of definite value in the diagnosis. The radiological findings in this condition are as follows: (1) In 75 per cent of the cases there is hypertrophy of the left ventricle; (2) the aortic knob is absent; (3) over 50 per cent of the cases show aneurysmal dilatation of the first portion of the aortic arch; (4) erosion of the under surfaces of the ribs is noted in nearly all cases; (5) the bifurcation of the trachea is noted "pencilled out" in the left oblique position due to the absence of the aortic shadow.

J. N. ANÉ, M.D.

KNEE JOINT

The Roentgen Diagnosis of Old Injury to the Cruciate Ligament of the Knee Joint. F. Felsenreich. *Fortschr. a. d. Geb. der Röntgenstrahlen*, April, 1934, **49**, 341-346.

This paper is a careful roentgenologic study of the joint space at the knee and particularly the intercondylar eminences of the tibia. In an appreciable number of patients who have sustained injury to the knee joint one can later on detect evidence of trauma to the cruciate ligaments by changes in these intercondylar eminences and the adjacent fossæ, which represent chiefly proliferation of bone as an expression of the localized deforming osteo-arthritis. Such demonstrations seem to be of considerable judicial value.

H. A. JARRE, M.D.

Knee-joint Visualization: A Roentgenographic Study with Iopax. Douglas Boyd. *Jour. Bone and Joint Surg.*, July, 1934, **16**, 671-680.

The author studied the x-ray appearance of the visu-

alized knee-joints of seven patients after the injection of the articular spaces with iopax solution. Michaëlis, in 1931, employed iopax in a similar study. However, his patients were kept in bed, under observation, for one or two days, whereas, the author's series consisted of ambulatory patients only.

In this study the patients were taken directly to the x-ray department without previous preparation. The solution used was an autoclaved 30 per cent iopax, dissolved in 0.5 per cent novocain. The injection was made with surgical aseptic technic directly into the suprapatellar pouch, from the lateral aspect of the joint at the level of the superior border of the patella. If effusion was present, this fluid was first aspirated before the injection. If no fluid was present in the joint, salt solution was first injected and withdrawn to make certain of the position of the needle, after which the iopax solution was injected. Roentgenograms were then taken. The leg was then manipulated through its full range of motion and additional films were made with the leg in flexion. After the roentgenograms had been taken as much of the solution as possible was withdrawn. The puncture site was then dressed and an elastic bandage was placed over the joint. Rest in bed for a period of 48 hours and heat to the joint was prescribed. It was determined that from 25 to 35 c.c. of the solution was sufficient for good shadows.

The following conditions of the knee-joint were studied by this method: villous synovitis, hypertrophic arthritis, Charcot joint, infectious arthritis, and popliteal bursitis. No unfavorable reactions were noted in any case. Of interest also is the fact that three patients were relieved of previous joint pain and effusion.

It is believed that with further study of the x-ray appearance of the visualized knee-joint this method will prove of diagnostic value and that it may even yield therapeutic results. The procedure was without danger as used by the author and, while the solution produced a hyperemia of the synovial membrane, no cellular exudate was observed.

J. N. ANÉ, M.D.

PARATHYROIDISM

Hyperparathyroidism Due to Diffuse Hyperplasia of All Parathyroid Glands Rather Than Adenoma of One. (Clinical Studies of Three Such Cases.) F. Albright, E. Bloomberg, B. Castleman, and E. D. Churchill. *Arch. Int. Med.*, September, 1934, **54**, 315-329.

Three patients with clinical hyperparathyroidism were found at operation to have multiple parathyroid enlargements, considered to represent hyperplasia of all parathyroid tissue. The authors state that they attach no significance to the fact that none of their three patients had bone disease. They consider this a complication of the disease, dependent on duration, degree, and dietary habits, rather than a necessary feature. The metabolic findings were typical of hyperparathyroidism. The data for the urinary excretion of cal-

cium and phosphorus were not given, but very large amounts were excreted by patients for whom these values were determined.

The histologic structure of the glands in these patients differed markedly from that in 16 cases from the clinic in whom only solitary parathyroid enlargements were present. The distinctive features were the uniformity of structure, the enormous size of the cells, the extreme clearness of the cytoplasm, and the tendency to glandular formation.

A distinction is made between parathyroid hyperplasia with hyperparathyroidism and compensatory hyperplasia of the parathyroid glands. An analogy between the former and exophthalmic goiter is made.

Hyperplasia of the parathyroid glands with hyperparathyroidism is considered a disease entity.

The surgical treatment of parathyroid hyperplasia with hyperparathyroidism brings up some interesting questions. Thus removal of two enlarged glands in one of these patients was without effect on the serum calcium and inorganic phosphorus levels. Even with removal of sufficient tissue to alter the blood chemistry satisfactorily, the condition is apt to recur. It is still undecided whether this condition can be handled by surgical means.

A review of 101 cases of hyperparathyroidism revealed 17 cases, including these three, in which there were multiple parathyroid enlargements. Several are undoubtedly similar to the ones here reported. The records of the cases of multiple parathyroid tumors have abundant circumstantial evidence in them to suggest that the pituitary gland is incriminated. The cause of the hyperplasia is probably a parathyroid-stimulating factor, possibly the Hertz and Krane's of the pituitary described by Hertz and Krane.

H. A. JARRE, M.D.

RADIATION EFFECTS

The Effects of Roentgen Irradiation upon Carriers and Excretors of Diphtheria Bacilli. E. D. Dubowiy, N. A. Grinberg, M. T. Prodan, and O. W. Geffer. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, September, 1934, **50**, 294-299.

Irradiation of the pharynx and tonsils with from 20 to 35 per cent of an erythema dose at 210 K.V., 0.05 mm. aluminum, is reported to have rendered most of these individuals free from bacilli within a week's time.

(The paper undoubtedly is open to much discussion and criticism in spite of quotations from several American authors—Hickey, Witherbee, and others.)

H. A. JARRE, M.D.

ROENTGEN-RAY THERAPY

Concerning Disturbance of Bony Growth and Retardation of Development of the Female Mammary Gland as a Result of Roentgen Irradiation during Infancy and Childhood. G. F. Haensch. *Fortschr. a. d. Geb. der Röntgenstrahlen*, July, 1934, **50**, 78-86.

This paper by the well-known author first gives a

complete critical review of the literature concerning the subject. In this review it is especially pointed out that in older reports quite frequently a differentiation between the effects of irradiation and primary disease for which irradiation was employed is not possible, that furthermore, dosimetric data frequently are quite defective. A case is then reported of true limitation of growth of bone by roentgen irradiation in early youth, producing simultaneously marked failure of development of the female mammary gland. This case is particularly remarkable because it demonstrates clearly limitation of bony growth by roentgen irradiation without primary underlying bony disease. It is pointed out in the paper, furthermore, that during irradiation of young children the possibility of the production of defective growth must be kept in mind and that particular caution is necessary with the dosage to be applied. One must be particularly cautious with indications for x-ray therapy during the first three years of life, though in serious conditions well directed roentgen treatment, even with heavy dosage, may become necessary to save a child's life at the risk of later deformity.

H. A. JARRE, M.D.

THE SKULL (DIAGNOSIS)

Deformation of the Sella Turcica in Tumors of the Middle Cranial Fossa. Karl Kornblum. *Am. Jour. Roentgenol. and Rad. Ther.*, January, 1934, **31**, 23-30.

Using a previously suggested classification of intracranial newgrowths not arising from within the pituitary fossa, into the three groups, (a) suprasellar, (b) parasellar, (c) metasellar, the writer reviews 40 verified cases of tumor occurring in the middle cranial fossa (parasellar), to determine the frequency of sufficiently characteristic sella changes to correctly classify them as falling into the parasellar group. Thirty-four (or 85 per cent) of the series showed sellar deformation while only 12 cases (or 30 per cent) showed other roentgenologic signs of tumor (most commonly calcification). Sellar changes most commonly seen in the parasellar group are: (1) erosion of dorsum manifested by indistinctness of structure; (2) intact but indistinct posterior clinoids; (3) slight enlargement of the fossa (often only top limits of normal), these erosive changes being regularly unilateral and often best demonstrated by films taken with the head in a position slightly oblique from the true lateral.

The most helpful single clinical finding taken in conjunction with the above-described x-ray changes, is a homonymous hemianopsia, with a varying degree of motor weakness.

J. E. HABBE, M.D.

THE SPINE

Non-tuberculous Infections of the Spine. Armitage Whitman and Raymond W. Lewis. *Jour. Bone and Joint Surg.*, July, 1934, **16**, 587-593.

While tuberculosis and chronic osteo-arthritis of the spine may be recognized by their roentgenographic appearance, other known types of infection of the spine,

such as osteomyelitis, typhoid arthritis, syphilis, Neisserian infection, fungus infections, undulant fever, and unclassified infectious arthritis are differentiated roentgenographically and clinically only with difficulty and uncertainty. The authors report a series of four cases of such non-tuberculous spine infections.

Case 1, a woman of middle age, presented a history of an abrupt onset of pain in the back eighteen months before. For the next four to seven weeks she was ill with what was called intestinal influenza. Although she enjoyed some comfort after the subsidence of her intestinal condition, for several months, following a motor trip, she again experienced pain and stiffness in the back, which increased in severity. Under general anesthesia, her spine was placed in proper alignment and a plaster jacket was applied. About two years following this treatment roentgenograms revealed a destruction of the discs between the second and the third and also between the fourth and the fifth lumbar vertebral bodies, with bony bridging between the adjacent margins of these vertebrae. This case was believed to belong to the class of infectious arthritis, following intestinal influenza or to the osteomyelitis group.

Case 2, a woman, aged 29 years, complained of pain in the dorsal region of one year's duration. There was no history of injury. Roentgenographic examination showed narrowing of the intervertebral disc between the fifth and sixth dorsal vertebral bodies. The most likely diagnosis of this case was believed to be unclassified infectious arthritis.

Case 3, a man, aged 20 years, complained of pain in the lumbosacral region of two months' duration. There was no known etiology except over-exertion brought about by lifting stones at a summer camp. No constitutional symptoms were noted. Roentgenographic examination showed a rounded area of bone destruction and bone production at the superior anterior margin of the body of the third lumbar vertebra, with considerable narrowing of the disc between the second and third vertebral bodies. A plaster jacket was applied and examination one year later showed a filling in with new bone of the area of bone destruction in the third lumbar body. This case was believed to be a case of low-grade pyogenic abscess of a vertebral body with involvement of the intervertebral disc.

Case 4, a man, aged 22 years, presented a history of four discharging sinuses in the following locations: Left groin, lumbosacral region, over the right hip, and over the right sacro-iliac region. Eight years previously he had had many boils. His illness began with high temperature and severe pain in the small of the back. Repeated smears, cultures, and guinea-pig inoculations failed to reveal the presence of tuberculosis. X-ray examination after injection of the sinuses with a 12 per cent solution of sodium iodide showed that the sinuses led down to the right fifth transverse process and to the right of the bodies of the fourth and fifth lumbar vertebrae. Narrowing of the intervertebral disc between the fourth and fifth bodies with roughening of the adjacent surfaces of the bodies and

erosion of the right transverse process of the fifth lumbar vertebra with sequestrum formation were also noted. Because of the exclusion of tuberculosis and the history of boils this case was believed a chronic non-tuberculous osteomyelitis and arthritis of the spine.

J. N. ANÉ, M.D.

Chronic Rheumatic Diseases of the Spine. J. L. Miller. Arch. Int. Med., August, 1934, **54**, 161-169.

The two types of chronic rheumatism seen in the extremities may also affect the spine. Rheumatoid arthritis of the spine may be followed by pathologic changes recognized as spondylitis ankylopoietica. The cause of the early and frequent incidents of osteo-arthritis of the spine is discussed. Extensive reference is made to the investigations and publications by German authors, especially G. Schmorl and H. Junghanns. (In "Die gesunde und kranke Wirbelsäule im Roentgenbild," Leipzig, Georg Thieme, 1932, where a complete bibliography on chronic rheumatism of the spine may be found.)

H. A. JARRE, M.D.

THE STOMACH

Thoracic Stomach. H. W. Goodall and L. H. Hoyt. Arch. Int. Med., April, 1934, **53**, 594-614.

Report of five cases, three of which carried the greater part of the stomach above the diaphragm, two only small cardiac segments. The authors draw attention to the relative shortness of the esophagus, which configuration they consider to be of etiologic importance. The viewpoint of the writers and their deductions are open to much criticism.

H. A. JARRE, M.D.

SYMPHYSIS PUBIS

Adolescent Osteochondritis of the Symphysis Pubis, with a Consideration of the Normal Roentgenographic Changes in the Symphysis Pubis. Michael Burman, Isaac Newton Weinkle, and Maurice J. Langsam. Jour. Bone and Joint Surg., July, 1934, **16**, 649-657.

The authors report the case of a young man, 17 years of age, who was pinned between a slowly moving auto truck and a fence. Examination after the accident revealed tenderness only over the lower part of the right rectus abdominis and pyramidalis muscles. No tenderness over the bony parts of the symphysis pubis was noted. The treatment consisted of rest in bed with an ice bag over the lower abdomen, and in a period of two weeks he was entirely symptom-free. He remained entirely well until slightly over four months from his injury at which time he experienced a dull, dragging pain in the region of the symphysis pubis. Roentgenographic examination showed an irregular, woolly appearance of the symphysis pubis, with an excess of the mammillation frequently noted at this period. The pain gradually disappeared under treatment, and about one month later stereoroentgenograms of the symphysis showed an advance in the disease process. Although symptom-free at this

time treatment was continued. Approximately five months later the patient was examined and stereoroentgenograms at this time revealed that the symphysis was much smoother.

The authors studied the normal roentgenographic appearance of the symphysis pubis in a series of 127 patients, of both sexes and of various ages. It was noted that in the very young the symphysis is broad, and flares outward above and below. The ischio-pubic junction does not join until the age of four years. While this region may show two or three areas of vacuolation, bordered by a line of condensation, it is considered normal for this age period and not a sign of osteochondritis. From the tenth year on, the symphysis pubis often shows horizontal grooving or mammillation, which is more manifest in the earlier years of the second decade. Toward the age of twenty years, the edges of the symphysis pubis become smooth, are more vertically placed, and approach the adult type. In the third decade mammillation or grooving is no longer seen, and the symphysis measures about one-eighth of an inch. From 45 to 60 years of age the interspace of the symphysis is reduced and measures less than one-eighth of an inch. From 60 to 75 years of age an increase in the lipping and narrowing is noted.

J. N. ANÉ, M.D.

THORAX

Roentgenological Examination of the Chest in Lateral Decubitus. Samuel Brown. Am. Jour. Roentgenol. and Rad. Ther., January, 1934, **31**, 41-43.

The writer has tested the value of the chest examination in the lateral decubitus position (after the method of Rigler, described by that author in 1931), and finds that in some instances especially in cases in which there is considerable fluid present, the lateral decubitus position with the *affected side up* may afford valuable diagnostic information not found otherwise. An especially good example illustrated by the author was that of a case of endothelioma arising from the lower axilla, the tumor shadows being visualized only in the lateral decubitus, affected side up. A simple apparatus for elevating the patient above the table and for supporting the cassette is described and illustrated.

J. E. HABBE, M.D.

TUBERCULOSIS OF BONES

Tuberculosis of the Shaft of the Large Long Bones of the Extremities. C. K. Hsieh, Leo J. Miltner, and C. P. Chang. Jour. Bone and Joint Surg., July, 1934, **16**, 545-563.

Tuberculosis of the shaft of the large long bones of the extremities has been classified by the authors into four types according to the roentgenographic appearance.

Type I, or "Tuberculous Periostitis," is considered the rarest form of shaft tuberculosis. It is characterized by a rarefied, laminated, periosteal proliferation with no involvement of the underlying cortex.

Type II is known as the "Solitary Tuberculous Abscess (Brodie's Type)" and consists of a single area of destruction, usually located centrally in or near the metaphysis. While in the early stages no change is noted in the surrounding bone, in the later stages condensation usually occurs around the periphery of the lesion and sequestra may be present. Late in the course of the disease, with involvement of the neighboring bone by direct extension, it may be impossible to distinguish this type from Type III.

In Type III, or "Localized Tuberculous Osteomyelitis," the involvement of the shaft is more extensive. In the early stages of the disease, the medullary and cortical portions of the bone appear hazy, and scattered rarefied areas of destruction are noted. Later a certain amount of involucrum may be noted which may be similar to that found in pyogenic osteomyelitis, especially after the formation of sinuses and the addition of secondary infection.

Type IV, which is designated as "Massive Tuberculous Osteomyelitis," shows in the early stages marked decalcification of the shaft usually with a fusiform swelling of the periosteum and surrounding soft tissue. Since the circulation of the periosteum is not seriously involved laminated layers of involucrum may be seen after several weeks or months.

The authors noted in the series of 20 cases which they report that in the majority of these cases the onset was insidious and the course chronic. Pain of a dull, aching character and muscle spasm were present for several days or weeks, following which soft-tissue swellings developed gradually. A slight febrile reaction, general malaise, and a slight loss in weight were noted in these cases. The abscesses were not usually of the "cold" type but formed directly over the diseased areas of the bone and tended to rupture spontaneously after several weeks. This form of tuberculous infection could be differentiated from pyogenic osteomyelitis in that the onset was less acute, the pain less severe, and the febrile reaction was less pronounced.

It was found advisable in studying this condition to obtain roentgenograms of the lungs in every case of tuberculosis of the bone, for it was noted that patients with shaft tuberculosis and active pulmonary lesions did not usually respond favorably to treatment. On the other hand, approximately 75 per cent of the uncomplicated cases of shaft tuberculosis responded favorably, following the usual orthopedic care.

The treatment of the closed lesions consisted of the unroofing of the diseased area of the bone and the excision of as much as possible of the diseased bone and soft tissue. The open cases were treated in the same manner as the ordinary case of osteomyelitis.

J. N. ANÉ, M.D.

TUMORS (DIAGNOSIS)

Osteoid-tissue-forming Tumor Simulating Annular Sequestrum. Henry Milch. *Jour. Bone and Joint Surg.*, July, 1934, 16, 681-688.

In 1930, Hitzrot reported the case of a woman who presented a painful and swollen wrist which on roentgenographic examination revealed an unusual involvement of the carpal scaphoid. The lesion appeared as a decalcified area, containing a very dense piece of bone. The entire area was surrounded by an annular shadow of sclerosed bone. The author presents four additional cases with similar history, clinical findings, roentgenographic examination, and histologic study, and he believes that all five cases should be classified as benign osteoblastic osteoid-tissue-forming tumors.

The characteristic findings in these cases were pain, swelling, and roentgenographic evidence of involved bone. The pain is described as constant, of a dull, boring character, worse at night and after exertion. The swelling is localized to the involved region. Since these signs are common to many conditions the roentgenogram alone is considered diagnostic of the lesion.

While the roentgenographic appearance may seem similar to that of an annular sequestrum lying free in a cavity, closer observation shows that the lesion is made up of several parts. In the early stages the central area is quite uniformly dense but in the later stages this central portion appears to be subdivided into a peripheral annular zone of radio-opacity, surrounding a central lighter area which may represent the site of tumor necrosis. Beyond this central area there is noted an area of radiotranslucency, which is traversed by radially arranged opaque striations, which seem to unite the central area with the surrounding bone. This is believed to be the bone of the osteoid tissue which is relatively translucent to the x-rays. The entire lesion may be sharply demarcated by a dense circular shadow from the normal bone or the surrounding tissues may reveal a reactive process.

Although three of the five cases presented gave a history of trauma, because of the considerable variation in the lapse of time following injury as compared to the development of the lesion, the author is of the opinion that injury is not related to the development of the tumor. The treatment of this condition consists of the complete eradication of the tumor.

J. N. ANÉ, M.D.

THE UTERUS

Results of Radiation Therapy in Carcinoma of the Uterus Treated from 1926 to 1931. W. Dieterich and A. Edinger. *Strahlentherapie*, 1934, 50, 557-565.

The authors compiled statistics of the results obtained by radiation therapy in uterine cancer. A total of 237 cases treated from 1926 to 1931 could be traced. Combined x-ray and radium therapy appeared to be the most efficient method. Usually a total of from 5,000 to 6,000 mgh. was applied (1.0-1.5 mm. brass). The distribution of the screens of 10 mg. each and the sittings depended on the needs of the individual case. Roentgen technic: 180 K.V., 3-4 ma., 0.5 mm. Cu, H.V.L. in Cu, 0.9 mm., 40 cm. F.S.D., 10 × 15 or

20 × 20 cm. field size, not more than 360 r (in air) per sitting, 1-2 fields per day, total of 600-720 r effective in the tumor. Of the entire material, 89 (or 37.59 per cent) were alive on April 1, 1934. A series of tables is presented permitting an analysis of the results in more detail. It is encouraging to note that of 124 inoperable carcinomas of the cervix, treated by irradiation, 19.6 per cent were alive at the time of the report. Thorough and prolonged follow-up examinations of these patients are most essential.

ERNST A. POHLE, M.D., Ph.D.

The Primary Morbidity and Mortality of Intensive Therapy of Carcinoma of the Cervix. Heinz Kirchoff and J. Drenckhahn. *Strahlentherapie*, 1934, 50, 428-445.

The primary morbidity and mortality was studied in 924 cases of carcinoma of the cervix observed during 1922-33: 401 cases were operated on, 459 cases treated by radium, and 64 were incurable. The primary mortality of the radium cases was 3.9 per cent; no complications occurred in 60.3 per cent, slight complications in 24.4 per cent, and serious complications in 9.2 per cent. The primary mortality of the operation amounted to 8.72 per cent, with a higher mortality of the Wertheim operation over the Schauta operation. No complications occurred in 62.5 per cent, slight complications in 13.2 per cent, and severe complications in 13.7 per cent. A short paragraph is devoted to the precautions to be observed in order to avoid fistula.

ERNST A. POHLE, M.D., Ph.D.

The Selective Treatment of Carcinoma of the Cervix. M. Bolaffio. *Strahlentherapie*, 1934, 50, 566-575.

The author, who is professor of gynecology and ob-

stetrics at the University of Modena (Italy), advocates a combination of operation and irradiation in the treatment of carcinoma of the cervix. He feels that radical removal of the cervical growth offers the best guarantee for a permanent local cure. It is necessary, however, to carefully select early cases or to reduce the size of the involvement by pre-operative radium treatment. Neither irradiation nor operation guarantees the prevention of recurrence and distant metastases. In cases in which operation is planned, not more than from 3,000 to 4,000 mgh. should be applied in the cervix. In the inoperable cases, doses up to 7,000 mgh. applied within one week are indicated. If these cases do not become operable within one month, additional radium therapy may be given up to a total dose of 8,000 mgh., fractional roentgen therapy being applied in both instances. X-ray therapy is also given after operation.

The author concludes that his preliminary results of the combined treatment, namely, operation, pre-operative radium therapy, and post-operative x-ray therapy, are better than those of irradiation alone.

ERNST A. POHLE, M.D., Ph.D.

Further Results of Radiation Therapy in Uterine Carcinoma. Friedrich Voltz. *Strahlentherapie*, 1934, 50, 576-578.

In 1931 the author published statistics showing the end-results obtained by radiation therapy in uterine carcinoma. He presents now the same figures brought up to date. It may be mentioned that during 1927 and 1928, 316 women with carcinoma of the cervix were treated by irradiation, of whom 24 per cent were alive and well after five years. In the same period, 31 cases of carcinoma of the fundus were treated by irradiation, 11 of these being well five years later.

ERNST A. POHLE, M.D., Ph.D.

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